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TWENTY-SEVENTH
ANNUAL REPORT

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OF THE

FISHERY BOARD FOR SCOTLAND.

Being for the Year 1908.

IN THREE PARTS.

PART I.—GENERAL REPORT.
PART II.—REPORT ON SALMON FISHERIES.
PART III.—SCIENTIFIC INVESTIGATIONS.

PART II.—REPORT ON SALMON FISHERIES.

Presented to Parliament by Command of His Majesty.

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TWENTY-SEVENTH ANNUAL REPORT

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TWENTY-SEVENTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

LORD PENTLAND,

His Majesty's Secretary for Scotland.

OFFICE OF THE FISHERY BOARD
FOR SCOTLAND,
EDINBURGH, *May*, 1909.

MY LORD,

In continuation of our Twenty-seventh Annual Report, we have the honour to submit—

PART II.—REPORT ON SALMON FISHERIES.

We have again to report a decline in the total weight of salmon sent to market as shown by the return of salmon carried by the railways and steamships of the country. Last year the total was 104 tons short of the total for 1906. The weight reported for 1908 is 90 tons below that reported for 1907. In stating the total for 1908 we complete another period of five years when, as in the past, an average is struck. The figure for 1908 is 1555 tons, and the average for the last five years is 1865 tons. We have now three quinquennial averages with which to compare the totals. These averages are in order 2771, 2034, and 1865 tons. Taking the total weight of salmon reported as having been carried last season (1908) and comparing it with these three quinquennial averages, we find:—

A deficiency of 1216 tons compared with period 1894-1898
" " 479 " " " 1899-1903
" " 310 " " " 1904-1908

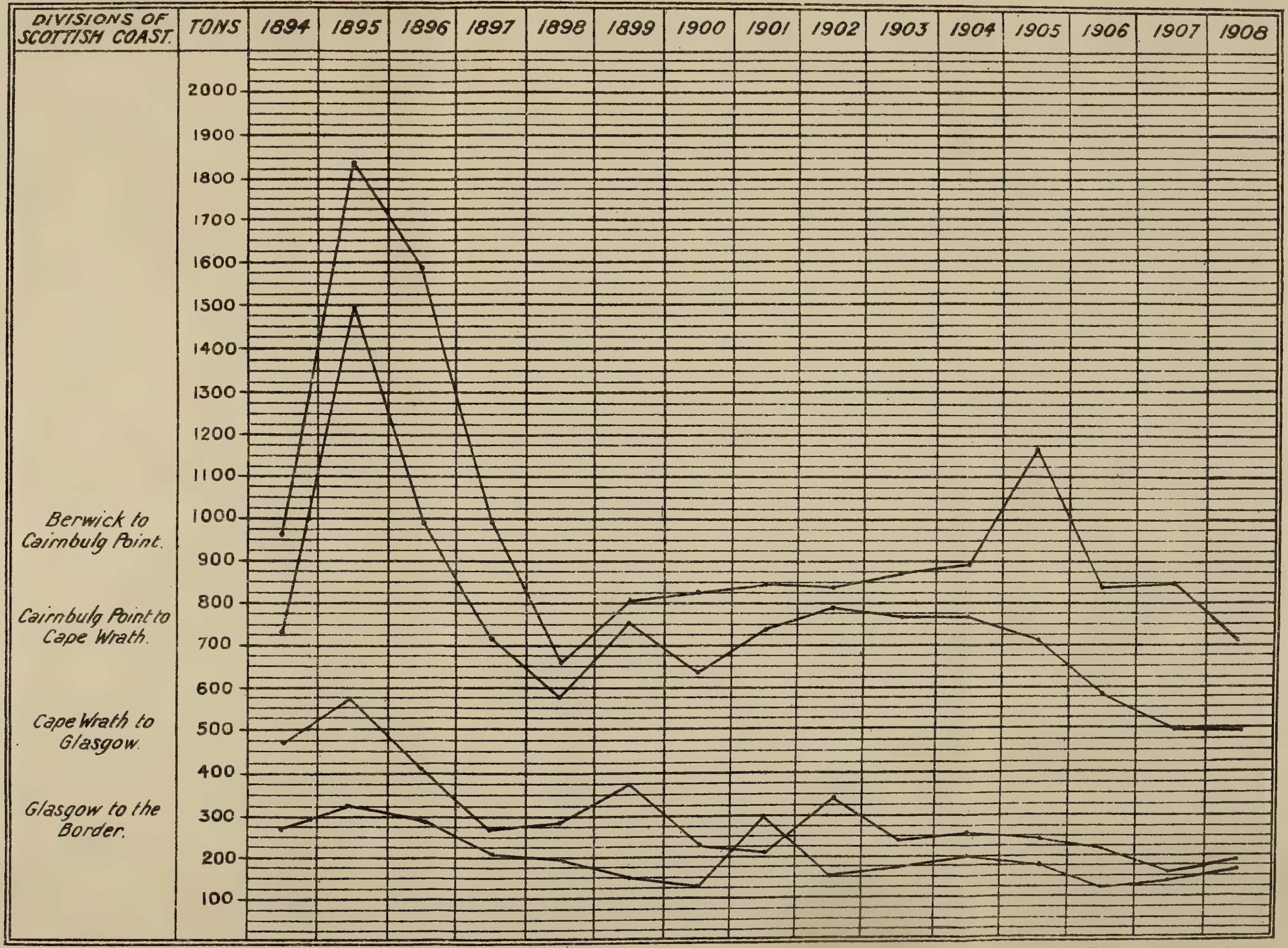
TABLE showing the Weights of Salmon Carried by Scottish Railways and Steamships.

District.	1894—Weight.				1895—Weight.				1896—Weight.				1897—Weight.				1898—Weight.				Average Weight.			
	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.
Berwick to Cairnbulg Point, .	963	8	2	23	1,834	1	3	24	1,583	6	1	26	987	5	1	4	666	8	3	13	1,206	18	1	1
Cairnbulg Point to Cape Wrath,	729	2	3	17	1,492	12	..	7	987	13	1	8	717	4	..	7	577	16	2	20	900	17	3	6
Cape Wrath to Glasgow, . .	471	13	3	4	576	7	..	10	414	2	3	5	270	15	..	1	283	18	2	1	403	7	1	21
Glasgow to the Border, . . .	273	6	..	..	326	..	1	17	293	3	..	1	219	8	..	21	189	..	..	20	260	3	2	6
Total, . . .	2,437	11	1	16	4,229	1	2	2	3,278	5	2	12	2,194	12	2	5	1,717	4	..	26	2,771	7	..	6

District.	1899—Weight.				1900—Weight.				1901—Weight.				1902—Weight.				1903—Weight.				Average Weight.			
	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.
Berwick to Cairnbulg Point, . .	819	17	2	6	826	17	3	26	845	10	1	3	835	3	2	23	867	18	1	14	839	1	2	9
Cairnbulg Point to Cape Wrath,	753	12	2	..	639	4	..	16	740	18	3	23	786	5	1	17	767	13	2	..	737	10	3	17
Cape Wrath to Glasgow, . . .	365	12	..	3	232	15	1	16	203	8	3	16	332	8	0	8	240	8	..	10	274	18	1	27
Glasgow to the Border, . . .	152	18	1	19	137	14	1	25	296	16	1	21	157	13	3	1	171	9	..	2	183	6	1	19
Total, . . .	2,092	..	2	..	1,836	11	3	27	2,086	14	2	7	2,111	10	3	21	2,047	8	3	26	2,034	17	1	16

District.	1904—Weight.				1905—Weight.				1906—Weight.				1907—Weight.				1908—Weight.				Average Weight.			
	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.	Tons.	Cwts.	Qrs.	Lbs.
Berwick to Cairnbulg Point, . .	881	17	2	27	1,158	1	..	24	834	7	1	22	847	1	1	2	715	15	3	16	887	8	2	24
Cairnbulg Point to Cape Wrath,	768	1	3	23	708	6	..	24	577	..	..	25	494	12	2	7	495	6	..	17	608	13	1	19
Cape Wrath to Glasgow, . .	251	6	..	20	241	13	..	21	214	..	3	9	159	10	1	22	179	8	1	12	209	3	3	6
Glasgow to the Border, . . .	196	4	2	6	172	18	..	12	124	2	..	17	144	7	1	23	164	17	..	19	160	9	3	15
Total, . . .	2,097	10	1	20	2,280	18	2	23	1,749	10	2	17	1,645	11	2	26	1,555	7	2	8	1,865	15	3	8

CURVES SHOWING APPROXIMATELY THE TONS OF SALMON CARRIED BY SCOTTISH RAILWAYS & STEAMSHIPS SINCE 1894.



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Of the three quinquennial averages, the second shows a decline of 737 tons from the first, and the last a decline of 906 tons. The details are set forth in the accompanying table, while the situation may be seen at a glance from the chart of curves also given. The low condition of the salmon supply already referred to in previous reports shows no sign of recovery under existing conditions.

Mr. Calderwood in his report draws special attention to the state of matters. We have repeatedly complained against the absence of returns showing the numbers of fish taken in all Scottish districts, and the consequent impossibility of obtaining an adequate view of the condition of the salmon fisheries placed under our supervision. The Inspector has drawn together the various returns which were given in evidence before the Royal Commission on Salmon Fisheries under the chairmanship of Lord Elgin, and has added a few returns he has been able to secure otherwise, confining himself to such returns as show salmon and grilse separately. The totals just submitted by us as representing, so far as we have information, the salmon marketed from the whole of Scotland in recent years, are clearly very far below the totals which were commonly reached in a single district some fifty to seventy years ago. Mr. Calderwood indeed refers to still earlier totals from the Tweed showing that the takes of grilse alone in that district, covering a period of twenty years in the early part of last century, never sank below a figure fully thirty times as great as the maximum take for the whole country shown in the above chart of curves, and on occasion was more than a hundred times as great. He further shows that in leading salmon fishery districts the ratio between grilse and salmon has very greatly declined, and he emphasises the need, in his opinion, of paying more attention to the part grilse play in the economy of our salmon fisheries. Decline always seems first shown in the stock of grilse, and is later echoed in the decline of the adult fish. Mr. Calderwood considers, therefore, that to secure a better supply of salmon it is necessary to catch fewer grilse.

Reports from Districts.

The Inspector has received reports from 33 salmon fishery districts. As regards general statements of the condition of the fisheries, these bear out the statements we have just made of the low state of the salmon supply. The districts of South Esk, Bervie, Ness, Kyle of Sutherland, Leven and Clyde, Nith, and Annan are reported as improved or above the average. It is noteworthy that in South Esk, Ness, and Kyle of Sutherland netting in narrow waters has been reduced, and that in the case of the others (except the Bervie, which is a coast fishery) pollutions of a serious kind have been reduced.

The assessable rental in the districts referred to, excepting the Awe, from which no statement of rental comes, is £121,521. The condition of rental in five leading districts is seen in the accompanying table. The high figure is attributable to recent increase in sporting value. Tweed and Tay show records.

[Table.

YEAR.	Tweed.	Tay.	N. Esk.	Dee.	Spey.
	£	£	£	£	£
1900, . .	..	22,548	6,510	18,989	..
1901, . .	..	22,558	6,466	19,418	8,608
1902, . .	..	22,663	6,494	19,455	8,146
1903, . .	15,338	22,648	6,494	18,393	8,147
1904, . .	15,439	23,099	6,494	19,078	7,396
1905, . .	15,499	22,675	6,489	19,332	8,364
1906, . .	15,499	22,838	6,485	19,068	8,740
1907, . .	15,732	23,202	6,490	18,940	8,990
1908, . .	16,093	23,508	6,474	18,893	9,243

Particulars of certain prosecutions under the Salmon Acts are dealt with, and those referring specially to the observance of the weekly close time and the necessity, owing to recent decisions, of removing leaders of fixed nets on Sunday, if unable to do so on Saturday, are taken notice of by the Inspector in his report. At the same time reference is made to the possible purification of all pollutions as shown by the results of investigations conducted by the Sewage Disposal Commission.

Appendices to the Report are on the following subjects:—

I. Abridged Reports from Districts.
II. Results of Salmon Marking, with a Chart showing recaptures on the coast (Sixth Paper).
III. A Report on a Male Kelt which had been accidentally retained in fresh water for a year, and which at the end of that period was found to be again ripe.
IV. A statement of the number of Scottish Salmon to which seals of the Fishmongers' Company of London had been attached, thus enabling a guarantee to be given that though sold in the Annual Close Time they were captured in the open season.
V. Rateable Value of Salmon Fishery Districts.
VI. List of Annual Close Times.
VII. List of Chairmen and Clerks of District Fishery Boards.
VIII. An Index to Part II. of the Annual Reports from 1892 to 1907 inclusive.

We have the honour to be,

Your Lordship's most obedient Servants,

ANGUS SUTHERLAND, *Chairman.*
D. CRAWFORD, *Deputy-Chairman.*
D'ARCY W. THOMPSON.
W. R. DUGUID.
L. MILLOY.
D. MEARNS.
H. WATSON.

WM. C. ROBERTSON, *Secretary.*

ANNUAL REPORT

OF

THE INSPECTOR OF SALMON FISHERIES FOR SCOTLAND.

MR. CALDERWOOD'S REPORT.

Fishery Board for Scotland,
April 1909.

I have the honour to submit my Report for the year 1908. My inspections took me round a considerable part of the coast which is fished by means of fixed engines, more especially in the West and North Highlands, and on the most thickly-netted areas in Scotland —the East Coast between Montrose and Aberdeen.

The old-standing difficulty, which has been felt since the regulation of salmon fisheries in any systematic manner has been attempted, and which has been repeatedly referred to, not only in official reports but in evidence before Royal Commissions, viz., the difficulty of obtaining any reliable information respecting actual takes of salmon now or in the past, was most forcibly brought to my notice. Very rarely is a Clerk of a District Fishery Board in a position to inform one as to whether sea or river fisheries are really improving or declining. Tenants of net fisheries do not care to make any statements for fear their rents will thereby be adversely affected. One is accustomed to hear that the season is a poor one or is the worst on record. Officially one has no means of independent judgment.

During the last two or three years, however, I have noticed that in certain localities reports of bad fishing on the coast have been accompanied by a reduction of nets and working expenses on the part of the tacksmen, and I am further aware that in a few instances fishings of very considerable importance are to be thrown up if rents are not reduced, or, again, that rents have been reduced after the production on the part of the tacksmen of figures showing the returns of recent years.

DECLINE OF GRILSE: ITS SIGNIFICANCE.

It has further struck me that these rather reliable signs of decline are occurring in districts where the success of the fishing depends principally on the supply of grilse rather than upon the supply of adult salmon. The reduction of netting in rivers and estuaries for the purpose of allowing greater numbers of breeding fish to ascend, as well as for the improvement of sport, is much on the increase. I wrote on this subject in the Twenty-fifth Annual Report. But in spite of the reduction of this, the most effective form of netting, the signs to which I have referred continue. I have therefore made an attempt to collect such data as are available respecting the state of the coast fisheries where records of grilse and salmon are presented separately.

When Lord Elgin's Salmon Fisheries Commission took evidence in 1900 and 1901, not a few tacksmen came forward with statements of actual catches extending over a considerable period; one or two factors on large estates having great interest in salmon fisheries did the same, and bodies such as the Tweed Commissioners and the Aberdeen Harbour Commissioners volunteered most valuable records. The last-mentioned Commissioners have further very kindly supplied me with complete figures and charts up to date. I should like here to state that, while netting tenants may naturally decline to make public the results of their fishings, they have not the same cause for objection if returns are made to a Central Authority who shall treat such returns as confidential, but use them for the proper guidance of the fisheries committed to their general supervision. It is clear that without such returns no adequate conception of the decline of the salmon fisheries over the whole country—if such decline exists—is at all possible.

The data I have been able to collect, although somewhat variable as to the period of time for which figures are given from different localities, embraces a wider geographical range than I thought possible when I commenced the collection. Certain parts of the country, such as the important fisheries on the Forfarshire coast, and the fisheries of Skye and of the Solway, are unrepresented, but I have been able to secure returns in which the salmon and grilse totals were kept separately from the districts of the Tweed, Tay, Dee, Don, Spey, Ness, Beauly, Brora, Helmsdale, Thurso, Forss, and the bag-net fisheries of both North and West Sutherland.

The object I have had in view from the first has been to ascertain (1) the proportion of grilse to salmon in different localities, with the view of showing any difference which may exist as between localities; (2) any evident decline in the grilse take. It has never been possible to make any estimate of this kind before, except in regard to individual and isolated localities.

I attach special importance to the study of the grilse catch. Fortunately, the great majority of returns available give grilse separately from salmon. In watching the habits of migration not only in the case of adult salmon, but also in the case of grilse and smolts, as I have been enabled to do through the "marking" experiments which we have now carried on for about eleven years, the enormous fluctuations of the grilse run in different years have been very apparent.

The information which we have also obtained as to the limited number of times very many salmon spawn, sheds an important light upon the direct result which may be produced upon the stock of fish in different localities. It is clear that far more grilse and salmon pass prolonged periods, including spawning seasons, in the sea, than was formerly supposed. The grilse and salmon which enter our rivers represent the fish which, in any given year, are alone responsible for the reproduction of their species that season.

Grilse are virgin fish, which still show to a great extent the habit of moving in shoals, or at any rate of making simultaneous migrations, in the manner seen in the earlier smolt stage of development. The smolts descend to the sea in April, May, and June. The first reappearance of these fish in fresh water, or on the coast near river mouths, is in the following summer, when, as grilse, they have attained the age of three to three and a half years.

Grilse are, however, taken in large numbers in bag-nets set at considerable distances from the mouths of rivers. Their wanderings are evidently pretty wide, but the noticeable fact is that they do not so occur till May, and do not as a rule become plentiful till June. Great captures are made, as it were, quite suddenly when the fish "strike the coast" in numbers. Certain favourable conditions are known to coast fishers when the takes of both salmon and grilse will probably be large, but salmon do not occur in the same numbers as grilse. Salmon in most localities are netted from the opening of the fishing season. Grilse do not come within the netted zone till summer. Yet the grilse captured outnumber the salmon captured in, I believe, all netted localities in Scotland, and enormously outnumber the salmon in many districts.

I may, I think, regard it as axiomatic that when large numbers of grilse are taken by net, large numbers are entering our rivers to spawn. In such seasons the fact that rod fishers find a plentiful supply of grilse in fresh waters is, I consider, sufficiently good proof. To demonstrate the fact is unnecessary, although reference to the point seems desirable for the sake of logical sequence. That a considerable proportion of grilse do not enter fresh water at this stage is, however, equally true. Investigations by marking and by the study of scale growth show that the small spring fish, which are so numerous in many early rivers, *e.g.*, Dee, Brora, Helmsdale, etc., are the grilse of the previous summer which did not enter fresh water to spawn, but continued feeding and growing in the sea till after the spawning season. I may mention in passing that in certain large rivers of Norway, as apparently also in the Rhine, grilse are or have become comparatively scarce. In the returns respecting the Dutch salmon fisheries I find that in 1873 the grilse showed, in the total catch, a percentage of 57 ; for a considerable period of years after that date the grilse formed 23 to 24 per cent. In 1903 the grilse formed 6 per cent.

In Scotland certain rivers which used to hold abundance of grilse do not appear now to do so. In the Tweed quite recently, as I am informed, the absence of grilse has been evident to all. My Tweed figures do not cover recent years, so that I am unable to show how the netting records stand. In other cases we have rivers which apparently never attracted grilse in any numbers, and rivers which are well-marked grilse rivers. It is quite possible that grilse after visiting one river may subsequently, as adult salmon, enter other rivers, and that this goes on more freely than is supposed. For instance, the Ness and the Beauly have a common estuary, the mouths of the rivers being about ten miles apart. The Ness never holds many grilse ; its spring fish are of the large class, and the great majority of its fish at all seasons are large fish. The Beauly, on the other hand, has always been pre-eminently a grilse river ; large fish such as are commonly caught in the Ness are scarce. When one turns to our marking results, one is struck with the fact that quite a fair number of grilse marked after spawning in the Deveron have been recaptured on the coast of Aberdeenshire, having left the Moray Firth entirely. The chart given in Appendix II. to the present report, p. 39, shows these recaptures. No doubt quite a number of grilse have also been recaptured in the river in which they were marked. The number of wandering grilse is, however, significant, and more marking of grilse may enable us to see a little further along this line.

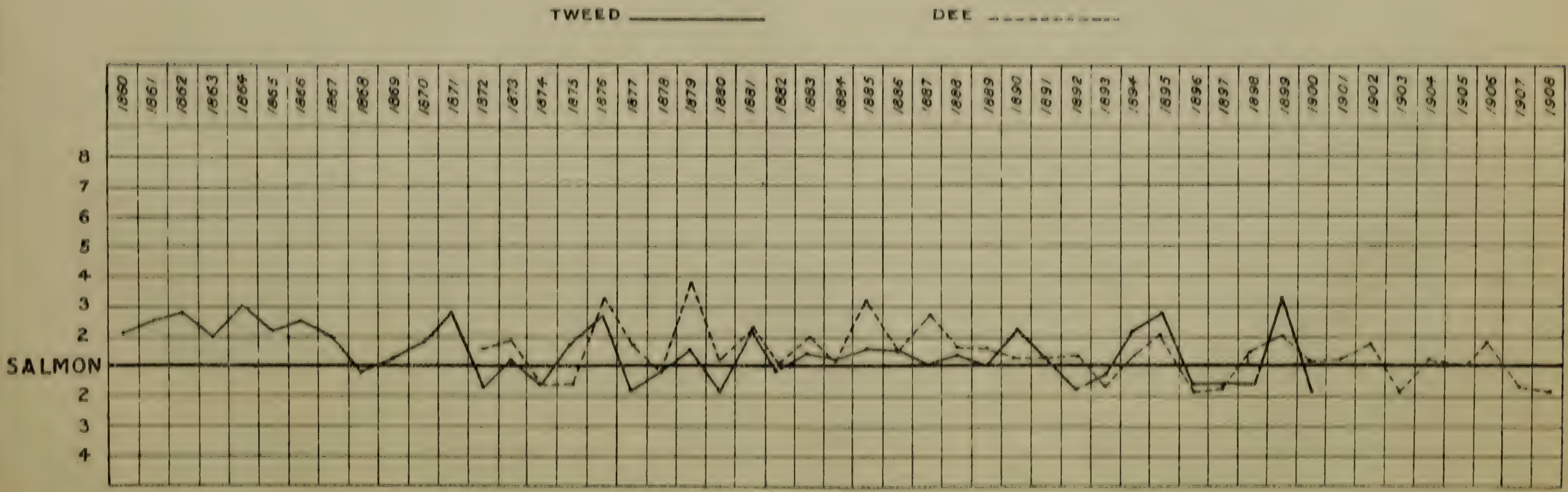
We have, then, the special features of the grilse which have been indicated. It is desirable further to ascertain more precisely how many grilse are taken for every salmon in the districts for which particulars are available, and this in spite of the fact that grilse are only caught for half the season. I am indebted to Mr. Fraser of this office for kindly going through the figures I have collected, and noting the number of grilse as compared with the number of salmon. I shall refer first to fisheries of the East Coast, commencing with the Tweed, then to more northerly fishings, and finally to the bag-net fisheries of the Pentland Firth and West Sutherland.

In the Tweed we deal with large takes of fish. The returns here referred to, however, only deal with the fisheries at Berwick. In 41 years there are 13 years in which the catch of salmon exceeded the catch of grilse. The period is 1860 to 1900 inclusive. I am unable to estimate the condition since 1900, but it is rather striking that in the last nine years referred to, six of them have produced fewer grilse than salmon. In the returns of the Aberdeen Harbour Commission (1872 to 1908) the grilse total falls below the salmon total on only nine occasions in 37 years, and in the period common to both returns (1872–1900) the Dee has six years of grilse deficiency, as compared with 12 in the Tweed, and only in one year do these years not correspond. In the period of the Dee's greatest prosperity —1881–1896—the high totals are attributable to the grilse catch. The actual totals in quinquennial averages during this common period are :—

	TWEED.		DEE.	
	Salmon.	Grilse.	Salmon.	Grilse.
1872–1876 ...	8,117	9,743	5,023	6,649
1877–1881 ...	5,751	7,286	4,935	7,036
1882–1886 ...	7,741	8,505	5,961	10,422
1887–1891 ...	7,209	9,079	7,036	11,616
1892–1896 ...	7,993	8,545	7,533	9,476
1897–1900 ... (4 years)	6,291	6,530	3,968	5,532

CHART No. 1.

Number of Grilse for each Salmon in Tweed and Dee.



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Taking averages, the grilse, of course, predominate in every case. In both districts, however, a shrinkage is noticeable in the last period of four years. This is still further marked in the later years of the Dee (1904–1908), the grilse average being only 4,696 and the salmon average 4,141. It is probable the Tweed figures would show a similar shrinkage, but I regret to say I have not been able to secure returns.

To show the detail, not with regard to total takes, but as regards the number of grilse taken for each single salmon each year, I have prepared the following chart (No. 1). It is noticeable that in districts so widely apart as the Tweed and Dee the excess of grilse and the deficiency of grilse harmonise pretty closely, showing that the cause of the rise and fall, whatever it may be, is operating similarly, and that the deficiency of grilse in the Tweed more often drops below the salmon level than in the case of the Dee. Also that never are there more than 3·8 grilse to one salmon in the Dee (1879), and 3·3 in the case of the Tweed (1899). This is in marked contrast to the conditions in other districts, to which I shall presently refer.

I may now turn to some very early Tay figures, for which I am indebted to Hon. Morton Stuart Gray of Gray and Kinfauns. The totals are extraordinarily large, and the period covered is from 1830 to 1846, or seventeen years. At that period the Tay was netted considerably above Dunkeld. The figures I have received represent the produce of 34 netting stations between Dunkeld and the estuary. The maximum number of grilse is 80,539, and the minimum 21,754. The salmon totals do not vary as the grilse totals do, the maximum being 35,126 on the year succeeding the maximum grilse figure. The average number of salmon for the period is 25,716, the average number of grilse 44,304. The excess of grilse in any one year never rises above 3·0 (on the maximum year.) On two occasions the grilse are less numerous than salmon, represented by 0·9 in each year. While the actual totals are far in advance of anything referred to in the Tweed or Dee, it is noticeable that the returns harmonise in the moderate excess of grilse over salmon. I am able, however, to refer to some very early Tweed returns kept by the late Mr. Paulin, and I find that some very great totals are recorded in the early part of last century. In 1816, for instance, the grilse are estimated as 120,596; in 1820, 116,495. After that, for a period of 21 years the figures are less, but never below 34,000, and in 1842 the figure rises to 189,935. Figures such as these are unapproachable under present-day conditions, and as the eye travels over the figures it is again evident that the greatest decline is in the grilse column, and is shown also in the relation the grilse total bears to that of the salmon total.

I will now refer to the Beauly, which, as already stated, is distinctively a grilse river, although the totals are never comparable to the early totals of the Tweed or Tay, but rather harmonise with the Dee grilse figures. In evidence before Lord Elgin's Commission, Mr. Garrioch, Lord Lovat's factor, gave figures for two periods, an early period from 1827 to 1838, and a later period from 1875 to 1900. Ten, eleven, and twelve thousand grilse in a year are not uncommon in the early period, the average being 8,466, while the salmon average is only 2,138, or 3·96 grilse to every salmon. In individual years there are excess percentages of 6·05, 5·85, 5·91, 5·35, and 5·64, the three last in three consecutive years.

In the later period the fluctuations of grilse are much more marked, and in respect of actual totals there is a decline, but the decline is not shown in the proportion of grilse to salmon, nor is the decline of grilse so great as that of salmon. It has to be noticed, moreover, that in recent years in the Beauly netting has been reduced, while the proportion of grilse to salmon rises to a high average level after the date (1893) of the reduction of netting. This I believe to be important to notice. I have drawn a curve representing the excess of Beauly grilse, and have placed it along with similar curves for the Brora and Helmsdale (Chart No. 2). It is again interesting to notice the almost complete harmony of the curves. In the case of the Helmsdale and the Brora from 1864 to 1884 there is singularly complete harmony, in which the Beauly joins from 1875. In 1885, however, a rise of the grilse excess is noticeable in the Helmsdale and Beauly curves which is not shown in the Brora line, and thereafter a few minor irregularities occur. From the time of the reduction of the Beauly netting, however, when in 1893 Lord Lovat decided to use nets on only two days in the week, and that after the grilse began to run, the Beauly grilse line takes its higher level. It does not reach as high a percentage as the Helmsdale does in 1876, 1881, or 1885, but it varies from between 4·5 and 7·0 when the other lines are down almost to the salmon level. The fact that the Helmsdale line should be so low since about 1889 requires some explanation. It is known that no nets are now used in the Helmsdale District, and that the river has the benefit of artificial floods from Badanloch Dam. The decline evident in this chart might therefore be misleading were it not stated that the year 1899, the year in which the line ends, was the year on which all netting ended also, and that for a period of four years previous to 1899 the coast on either side of the river mouth had been hard fished by bag nets. Any improvement in the ratio between grilse and salmon is therefore not possible of demonstration unless we could procure rod catches for the whole river in which grilse are noted separately from salmon. For the present, at all events, this rather important factor in the study of the question is not available, and in any case, as successful rod fishing depends on many things which do not influence the results of net fishing, a comparison of results would perhaps scarcely be trustworthy. The continuation of the Brora net and coble fishing enables the Brora line to be run on up to date and no rise in recent years is noticeable; but the Brora becomes very small in summer, and has not the benefit of any artificial floods, and has not had its netting materially altered.

The returns with which I have been dealing so far have been largely river returns. I now have five returns which are purely bag-net results, and which are from the shores of Caithness and North and West Sutherland. Gills, Forss, and Freswick are Caithness fisheries, and the returns respecting them were given in evidence before Lord Elgin's Commission by Mr. C. R. Sellar, the salmon fisheries lessee. These I have placed in black upon Chart No. 3. The returns for North and West Sutherland are

CHART No. 2.

Number of Grilse for each Salmon in Beauly, Brora and Helmsdale.

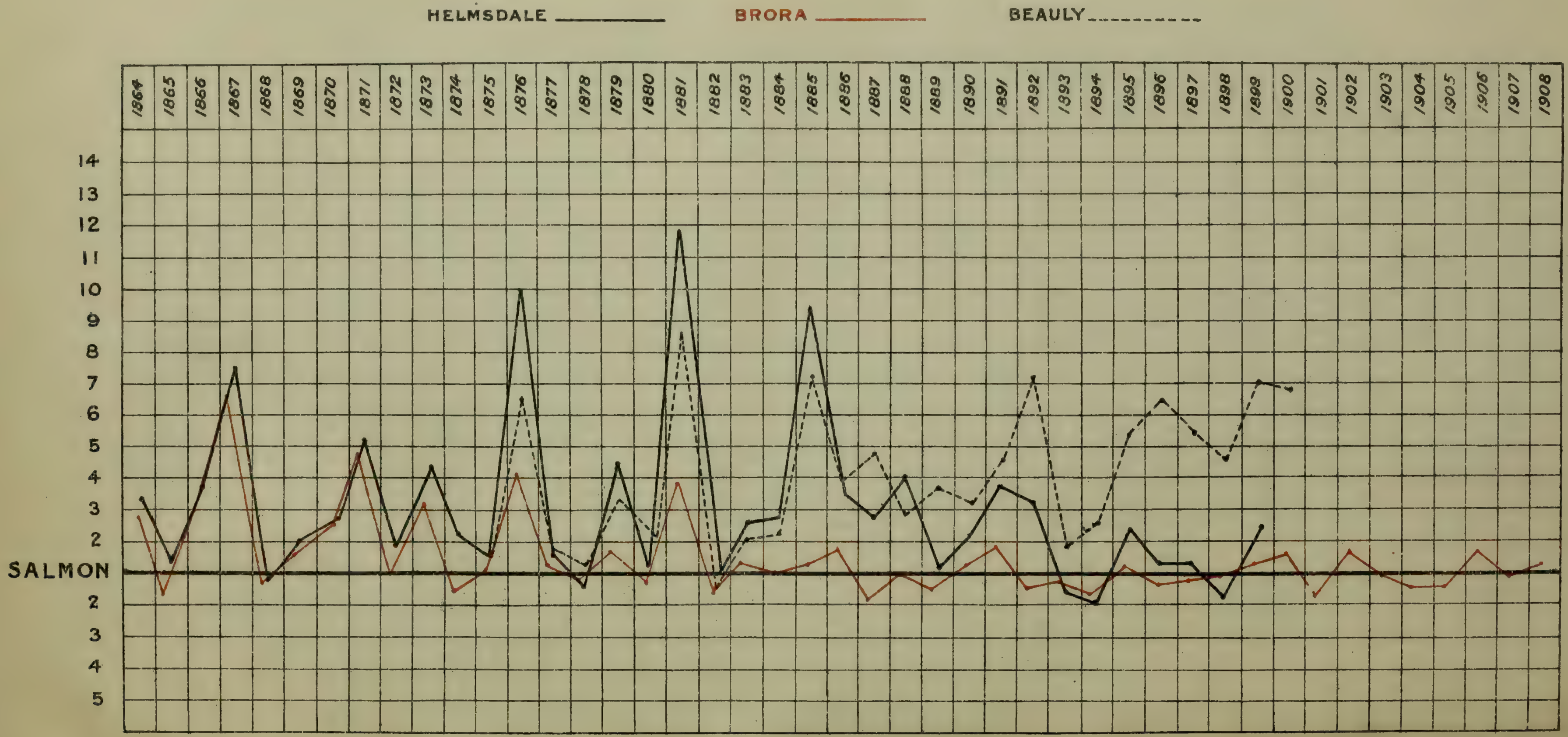

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CHART No. 3.

Bag Nets, Caithness and Sutherland.

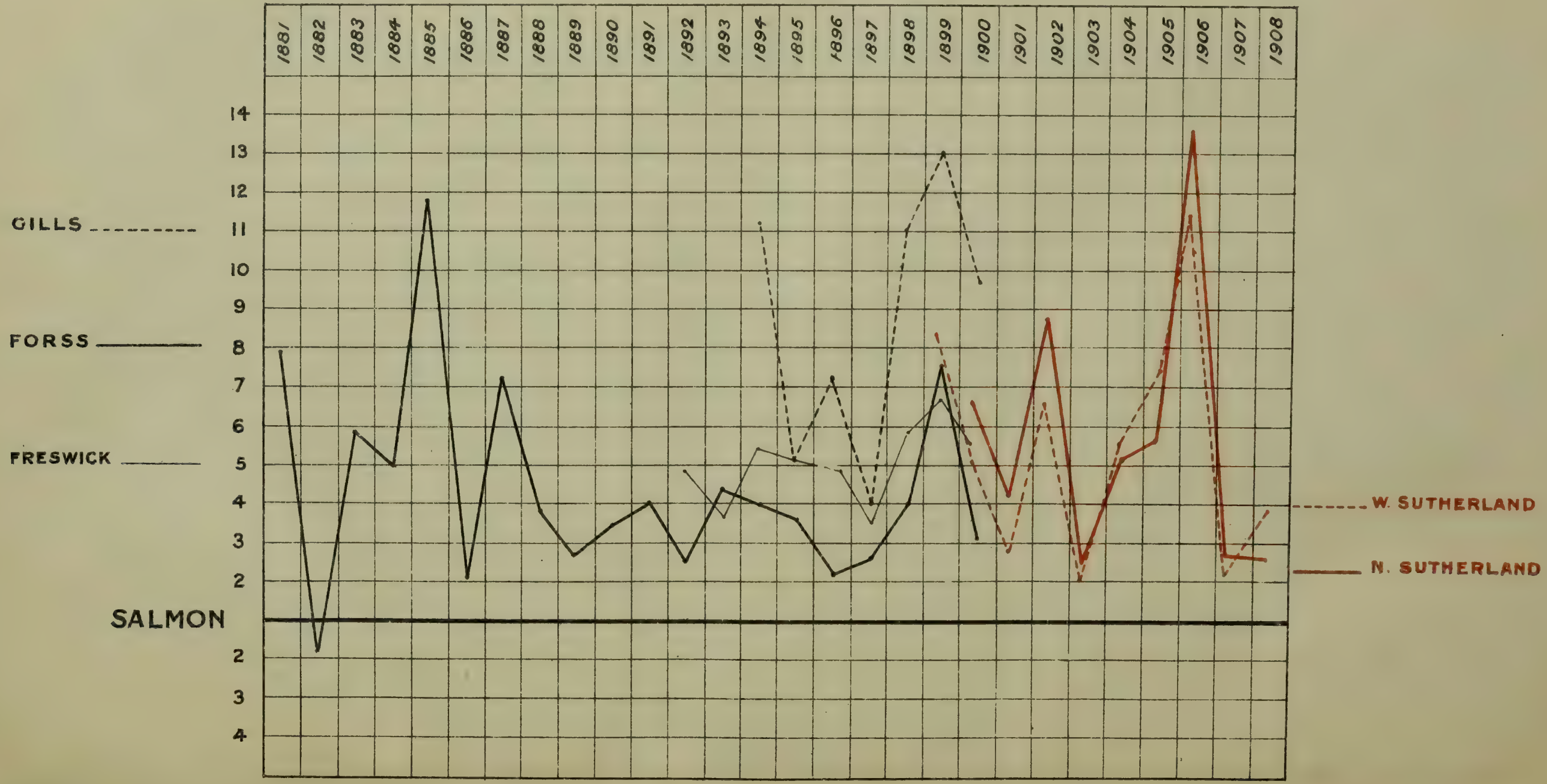

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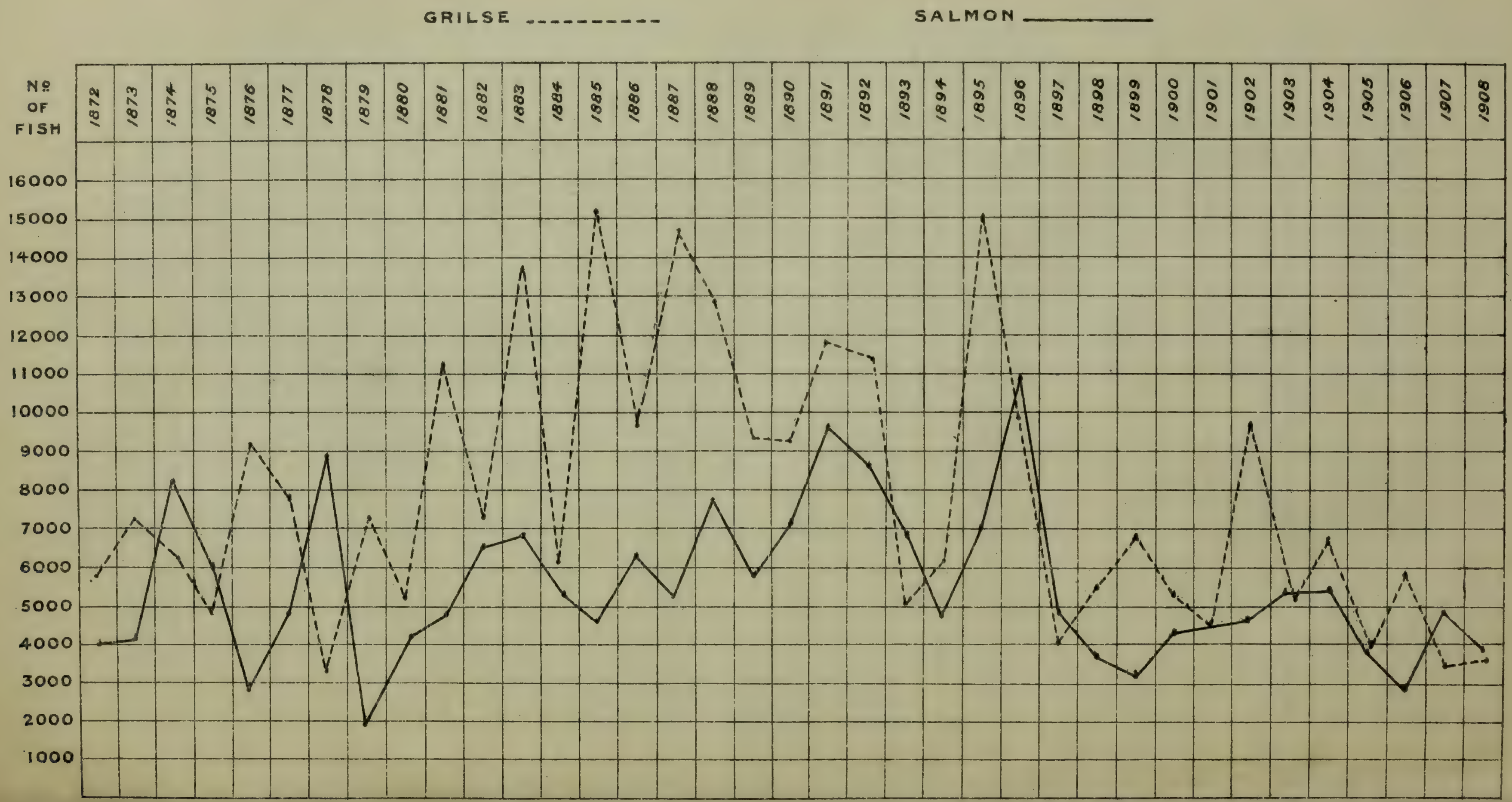
CHART No. 4.

Chart to show fluctuations of Grilse and Salmon during 37 years' fishing.
Return of Aberdeen Harbour Commission.



kindly supplied to me annually by Mr. Donald M'Lean, factor to the Duke of Sutherland. I have placed them upon the same chart. In all these returns violent fluctuations are present; the highest recorded excess of grilse is reached, and on only one year, in the case of one return, does the number of salmon exceed the number of grilse. The fluctuations are evident by a glance at the lines; the maximum point is reached by the line representing North Sutherland, where, in 1906, there were 13·6 grilse to every salmon taken. Gills fishing reaches 12·9 in 1899, and Forss 11·7 in 1885. These Pentland Firth records seem to show little relation to the Helmsdale and Brora results, but the period available is, unfortunately, not very great in any of them, and it is therefore impossible to notice if Pentland Firth features are in any way echoed, at possibly a later period, on the east coast of Sutherland.

Comparing the fluctuations of grilse and salmon (not shown in the charts), it may be said generally that while both rise and fall together to a considerable extent, the rise in the salmon line very commonly occurs in the one or two years succeeding the grilse rise. But the grilse rise is almost invariably short-lived. A high peak in the line is quickly followed by an abrupt drop. From this we may argue that the supply for the salmon total being quickly lowered, produces a corresponding depression in the salmon supply, and this is shown in the results of annual takes. To elaborate this, or demonstrate the condition in detail, would involve the production of an altogether undue number of figures, but the condition may be exemplified by the single chart, No. 4, showing the actual takes of the Aberdeen Harbour Commission during a period of 37 years. It is further noticeable that no cyclic recurrence of great grilse runs is shown.

So far as these returns go, then, and I do not doubt that fuller returns over a wider area would further bear out the results, it appears, 1st, that at the present time, in the case of large river fisheries such as those of the Tweed, Tay, and Dee, the proportion of grilse to salmon is not so great as in other districts in Scotland; 2nd, that this proportion is not so great in these large river districts as it previously was; 3rd, that the decline in the total takes is a decline both of grilse and salmon, but is very largely accounted for, or is chiefly seen, in the decrease of grilse; 4th, that the decline in the total takes is first shown in the reduction of the natural overplus of grilse, which subsequently is reflected in a decrease of adult salmon.

I do not here deal with the various causes which contribute to decline. An unknown percentage of loss naturally occurs after the smolts enter the sea and before the recognised grilse stage is reached in the sea. We can never hope to deal with loss from natural enemies in the sea. But very many important causes are induced by man, and affect the fish when in fresh water—overnetting, pollution, excessive land drainage, artificial obstructions. These all act as hindrances to the full reproduction of the species. The point I make here is that the various adverse forces show results first in the reduction of the grilse supply.

I cannot claim that the returns at my disposal are sufficient to make out a case for the whole country, but I think they are sufficient to call marked attention to the important part grilse play in the economy of our salmon fisheries, if not to act as a warning that for the conservation of our salmon supply we must contrive by legislation to allow more grilse to become salmon.

REPORTS FROM DISTRICT BOARDS.

I have received 33 reports from Salmon Fishery Districts. The two districts from which I hoped for reports, but from which they have not been received, are the Nairn and the Thurso. From the former I very seldom have received a report.

The fishing season of 1908 is reported as, in the majority of cases, below the average. The exceptions are South Esk, Bervie (a coast fishing only), Ness, where reduction of netting has recently taken place; Kyle of Sutherland, where nets are also not now so numerous as formerly; Leven and Clyde, where serious pollutions are now diminishing; Nith, where pollutions have also been treated, and Annan.

Approximate estimates of the actual number of fish taken are given from Tweed, Ugie, Ness, the Sutherland river districts, Leven, Ayr, Doon, Girvan, and in a few cases, such as Stinchar, Bladenoch, Cree, Nith, and Annan, the catches by rod are given. In the majority of cases no information can be obtained by the Clerks of Boards.

With regard to rentals, I offer the following list:—

	£		£
Tweed	16,093	Kyle of Sutherland	3,333
Forth	3,569	East Sutherland	2,160
Tay	23,508	West ,,	1,317
South Esk	3,674	North ,,	1,300
North Esk	6,474	Skye	540
Bervie	910	Lochy	2,880
Dee (Aberdeen)	18,893	Awe	—
Don	3,945	Ayr	159
Ythan	1,352	Doon	511
Ugie	809	Girvan	533
Deveron	3,381	Stinchar	400
Spey	9,243	Bladenoch	326
Findhorn	3,661	Cree	932
Ness	3,532	Dee (Solway)	1,231
Conon	2,967	Nith	506
Alness	455	Annan	2,947

The total is £121,521, but this figure takes no account of the Beauly, of the sporting value of the rivers in Sutherland not ascertainable separately from shootings, and of the large number of small West Coast districts where no Boards are established.

In protecting the rivers, the number of watchers varies not only according to the district, but also according to the season. In the Tweed as many as 55 bailiffs were employed in November, the number becoming reduced to 9 in June. Prosecutions were instituted against 208 persons during 1907–08. The principal offences were killing salmon by means of illegal nets, cleeks, and rakehooks, being in illegal possession of salmon and engines for killing salmon, and for assaulting and obstructing bailiffs. In the Forth, the Clerk to the District Board makes a general statement respecting drift and hang-net fishing as follows :—" The District Board have again been under " the necessity of using special measures for the suppression of the " illegal and destructive practice of fishing for salmon by means of " drift or hang nets, which still prevails, though to a greatly " diminished extent, in the lower waters of the estuary. A steam " launch was chartered in order to the efficient watching of " the waters during the last two months of the fishing season, " and detections when made were followed by actions of interdict, " or (in the case of persons who had been previously placed under " interdict) by penal proceedings for breach of interdict. The " District Board are now hopeful that this method of fishing, which " has been so injurious in its effects on the salmon fishing interests " of the river as a whole, will be given up on the Forth as it was " eight years ago on the Tay."

In the Tay 38 cases were tried in the Sheriff Courts, involving 62 persons. The offences were of the usual description, and 53 persons were convicted.

In the Conon district six fishermen from Cromarty were tried at Dingwall for a contravention of Section 1 of the Salmon Fisheries (Scotland) Act, 1844 [7 & 8 Vict. cap. 95], and were convicted. This section is directed against persons fishing for salmon within one mile of the shore not having a legal right or permission to do so. Prosecutions under the section are uncommon, but complaints have been made for many years that sea fishermen in this district persistently infringed the rights of salmon lessees under the guise of white-fish fishing. It is through the instrumentality of Mr. Middleton, the Clerk to the Conon Board, that the decision has been reached making it necessary for coast salmon fishers to slap their nets on Sunday if their doing so on Saturday evening is rendered impossible by reason of the weather. The decision, given on appeal, by a full bench in the High Court of Justiciary was included in my last year's report (p. 73). Proceeding from this, two cases were tried in the Girvan district during last season, and the Clerk to the Girvan Board refers to the matter as follows :—" There were two prosecutions " against lessees of salmon fishings for omitting to remove leaders " during the weekly close time. One, after lengthy proof, was con- " victed at Ayr Sheriff Court and fined £7 and £3 of expenses. The " other pled guilty at Girvan J.P. Court, and was fined £7 and £1 of " expenses.

" The Sheriff founded his conviction on failure to remove the " leaders on Saturday before midnight (the weather having been " stormy up to 6 p.m., but fine thereafter), but he indicated that, had " it been necessary, he was prepared to convict for the failure to " remove the leaders at the earliest opportunity on the Sunday, which " was a calm day throughout.

" The lessees actually did remove their leaders on the Sunday, but " not until 8 p.m., when a boat left the harbour to inspect the leaders " on behalf of the Fishery Board."

The case of *Middleton* v. *Tough*, and the review of the similar case of *Middleton* v. *Paterson*, also dealt with in the Justiciary Court, as already referred to, have done much to overcome the great laxity in the observance of the weekly close time which has prevailed in the past under cloak of Sunday observance. The express enactment of the Salmon Fisheries (Scotland) Act, 1868, as contained in Schedule D, must now be respected, and if at the commencement of the statutory weekly close time the performance of this duty is rendered impossible, the duty must be carried out whenever the weather moderates sufficiently to permit the " slapping " of the nets.

With regard to pollutions in rivers, a subject which demands increasing attention, complaints arise from several districts. In one or two localities remedial works are now in progress. Through the investigations and reports of the Sewage Disposal Commission it has been clearly shown that not only domestic sewage, but all manner of trade waste, can be satisfactorily treated, and that the extent to which purification may be carried need be limited, for all practical purposes, merely on grounds of expediency and expense. A very great amount of uncertainty prevails, however, on the part of District Fishery Boards, County and Municipal Authorities, as to the best methods of treating the particular impurities which may prevail in this or that locality. So long as this continues, and so long as advice on this highly specialised subject can readily be obtained only from those commercially interested in particular processes of purification, the natural reluctance of authorities to deal seriously with this growing difficulty in our rivers is likely to be evident, while, coupled with this, is the proved weakness of existing statutes to cope with this evil.

W. L. CALDERWOOD.

APPENDIX I.

AN ABRIDGED STATEMENT OF REPORTS FROM DISTRICT FISHERY BOARDS AND OTHERS.

REPORT FROM RIVER TWEED DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
   - (*a*) By fixed engine, approximately, 6814.
   - (*b*) By sweep net, actual, 37,223.
   - (*c*) By rod and line, approximately, 2115.

Note.—A considerable number of fish are captured in the open waters, of which it is impossible to give an estimate.

3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
By Fixed Engine, ...	...	...	...	...	15	30	45	14days 10	...	...
By Sweep Net, ...	3·14	2·43	5·6	7·47	15·29	28·27	22·43	14days 15·37	...	...
By Rod and Line, ...	2·5	4·13	3·8	·73	·66	·26	·46	5·63	32·4	49·43

Particulars as to the times grilse and sea trout appeared, as included in the above return, are as follows :—The first grilse caught by net was on 15th May. The first grilse caught by rod and line was on 23rd June. The greatest number of sea trout and grilse were caught by net in July and August, and by rod and line in October and November.

4. The weight of the heaviest salmon taken during the season was—By net, 48½ lbs. ; by rod and line, 43 lbs.

The particulars of time and place of capture are :—By net, caught at Goswick Fishery, early in August ; the exact date cannot be given. By rod and line, caught in Tweed, in Sprouston Dub, below Kelso, on 27th October.

Protection—

1. The assessable rental for 1908 was £16,093 5s. 1d.
2. The assessment levied was 20 per cent.
3. The water bailiffs employed are :—10 in July, 10 in August, 20 in September, 44 in October, 55 in November, 51 in December, 49 in January, 30 in February, 22 in March, 16 in April, 16 in May, 9 in June, and 1 engineer all the year round.
4. Particulars as to prosecutions instituted are briefly as follow :—Prosecutions were instituted against 208 persons during season 1907-08. Sixty-eight persons paid fine or were allowed time to pay, 90 were imprisoned, 23 absconded, 3 were acquitted, and proceedings were withdrawn in the case of 24 persons.

The principal offences were killing salmon by means of illegal nets, cleek and light and rake-hooks, being in illegal possession of salmon and engines for killing salmon, and assaulting and obstructing bailiffs.

Obstructions to the Passage of Fish—

1. Dam dykes disused, built, or in prospect:—Dam in Kale Water at Morebattle Tofts washed away in March 1908, and not renewed.
2. The provisions of the Tweed Acts are duly enforced and carried out.

Pollutions—

1. The existing pollutions are:—Poisonous matters from mills and dyehouses in Selkirk, Peebles, Innerleithen, Walkerburn, Galashiels, Hawick, Jedburgh, and Chirnside. Household sewage from Biggar, West Linton, Eddleston, Melrose, St. Boswells, Kelso, Coldstream, Sprouston, Ancrum, Lilliesleaf, Earlston, Lauder, &c.
2. Remedial measures:—There are settling tanks connected with all the mills in Peeblesshire which intercept the grosser parts of the mill effluent, but not much good. There are purification works connected with the mills in Galashiels and Selkirk, but those in Galashiels do not appear to be of any use, judging from the appearance of the water flowing from them; but a new system of drainage and purification is now in the course of being constructed.

   In Hawick there are irrigating tanks in a field, but they are not worked satisfactorily.

   A very expensive purifying plant has now been erected at Chirnside Paper Works with good results.

The Salmon Disease—

1. Disease made its appearance during season 1907-08 in the month of November, and reached its height in February.

   The river was free of diseased fish in May.
2. The number of diseased fish taken from the river and destroyed was as follows:—

	Males.	Females.
Kelts, - - - - -	2,860	2,757
Clean, - - - - -	273	442

The Spawning Season—

1. Fish were first noticed spawning on 20th October 1907 (sea trout).
2. The greatest number spawned in December and January.
3. Spawning ceased in the beginning of March.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as good.

Smolts—

1. Smolts were noticed to be migrating seawards in April and May.
2. As a smolt year 1908 was good.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was 376,000.
2. In securing ova the numbers of male and female fish captured were respectively 14 males and 37 females.

REPORT FROM FORTH DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 44¾ lbs.

   The particulars of time and place of capture are:—End of July, with sweep net, Herrick Station, about four miles below Stirling.

Protection—

1. The assessable rental for 1908 was £3569 8s. 9d.
2. The assessment levied was 4s. 6d. per £.
3. The water bailiffs employed are 10 in number and one superintendent.

Obstructions to the Passage of Fish—

1. Dam dykes disused, built, or in prospect :—As last year.
2. Are the bye-laws observed in every case ?—No. The bye-laws regarding hecks at intakes and outlets of mill lades are not properly observed.
3. Fish passes built or in prospect :—One in prospect on Airthrey Paper Mill dam dyke, Bridge of Allan.
4. Natural obstructions not yet dealt with are :—Kippenross old cruive on the River Allan.

Pollutions—

1. The existing pollutions are :—Sewage from the different towns on the banks of the Forth and its tributaries, and chemicals from bleachworks, dyeworks, paper mills, distilleries, and coal pits.

The Salmon Disease—

1. Disease made its appearance this year in the month of November 1907, and reached its height in January 1908.
   The river was free of diseased fish in end of March.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, - - - - -	479	145

The Spawning Season—

1. Fish were first noticed spawning at end of October.
2. The greatest number spawned in January.
3. Spawning ceased at end of February.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as about the average ; very high ; the past spawning season not very favourable owing to disturbance of the spawning beds with high floods during most of the spawning season.

Smolts—

1. Smolts were noticed to be migrating seawards in April, May, June, and July.
2. As a smolt year 1908 was about the average.

REPORT FROM TAY DISTRICT.

Take of Fish—

3. Particulars as to the times grilse and sea trout appeared are as follow :—Sea trout were got from the start, but chief takes in June. Grilse end of May, and a small crop. Chief run in July.
4. The weight of the heaviest salmon taken during the season was 62½ lbs.
   The particulars of time and place of capture are :—Caught by net and coble at Rushbush fishing station, near mouth of Earn, on 17th June (a male fish in excellent condition).

Protection—

1. The assessable rental for 1908 was £23,508 12s.
2. The assessment levied was £1645 12s. 3d., being at the rate of 7 per cent.
3. The water bailiffs employed are 24 in number.

Obstructions to the Passage of Fish—

1. Dam dykes disused, built, or in prospect—Inveralmond dam dyke washed away by flood on 18th January 1909.
2. Are the bye-laws observed in every case ?—No change since last report.
3. Fish passes built or in prospect :—Falls of Garry made easier and more salmon getting up.
   Negotiations for fish pass at Falls of Tummel in progress, with every expectation of the pass being available by another season.
4. Natural obstructions not yet dealt with are :—Falls of Tummel.

Pollutions—

1. The existing pollutions are :—Bleaching, dyeworks, and sewage—chiefly the latter.
2. Remedial measures :—Extensive filter beds are in course of making on the Earn at Crieff for the purification of sewage, etc., in that district.

The Salmon Disease—

1. Disease was prevalent every month of the year, and reached its height in December.
   The river was never free from disease.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, about 1000, . .	Say 700	Say 300
Clean, about 20, . .	Sex not often known.	

The Spawning Season—

1. Fish were first noticed spawning on 13th October on Erichdie, a tributary of Garry.
2. The greatest number spawned last half of November and first half of December.
3. None seen spawning after end of December.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as fairly satisfactory.

Smolts—

1. Smolts were noticed to be migrating seawards in March.
2. As a smolt year 1908 was considered under an average.

Artificial Propagation of Salmon.

Discontinued by this Board.

REPORT FROM SOUTH ESK DISTRICT.

Take of Fish—

3. Particulars as to the times grilse and sea trout appeared are as follow:—On 16th February first clean fish taken. Main run of sea trout, June. Main run of grilse and salmon, July and August.
4. The weight of the heaviest salmon taken by net during the season was 44 lbs., on the Rossie fishings, north of the river mouth.
   By rod and line no particularly heavy fish reported, but a number caught weighing from 25 lbs. to 30 lbs.

Protection—

1. The assessable rental for 1908 was £3674.
2. The assessment levied was £330 13s. 2d.
3. The water bailiffs employed are eight in number during the close season, and three during the fishing season.

Pollutions—

1. The existing pollutions are mostly from town and mills of Brechin.

The Salmon Disease—

1. Disease made its appearance this year about the middle of the month of September 1907, and reached its height in January 1908.
   The river was free from diseased fish in May 1908.
   The total number of diseased and spent fish taken from the river and destroyed was 784. Thirty-four clean fish were taken in April and May.

The Spawning Season—

1. Fish were first noticed spawning during the last week of October.
2. The greatest number spawned during November and December.
3. Spawning ceased by the end of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as good.

Smolts—

1. Smolts were noticed to be migrating seawards about 1st April 1908, and continued up to the middle of June.
2. As a smolt year 1908 was good.

REPORT FROM NORTH ESK DISTRICT.

Take of Fish—

2. The actual number of fish caught has been :—By rod and line, from 31st August, when net fishing closed, to 31st October, when rod fishing also closed, 379 salmon and 73 grilse, total 452, as recorded by bailiffs. No statistics as to fish caught otherwise.
3. For each month of the season the figures are :—

	Sept.	Oct.
By rod and line, ...	101	351

Particulars as to the times grilse and sea trout appeared, as included in the above return, are as follow :—

30 grilse were taken in September and 43 in October by rod and line.

The first grilse was taken in the sea on 22nd April, and in the river on 8th June.

Sea trout were taken in the sea and river early in May.

4. The weight of the heaviest salmon taken during the season by rod and line was 34 lbs.

The particulars of time and place of capture are :—September, Hatton ; but heavy fish were got all over the river.

Protection—

1. The assessable rental for 1908 was £6474.
2. The assessment levied was 6 per cent.
3. The water bailiffs employed are 12 in number, including superintendent.

Pollutions—

1. The principal existing source of pollution is the effluent from North Esk Distillery, about a mile from the mouth of the river.
2. Remedial measures :—Filtering tanks.

The Salmon Disease—

1. Disease made its appearance this year in the month of November, and reached its height in December.

The river was free of diseased fish in the end of March.

2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, ...	143	59
Clean, ...	122	139

Note.—There were also other 7 clean fish, the sex of which was not noted. With the exception of these 7, the above clean fish were spawning fish, unspawned.

The Spawning Season—

1. Fish were first noticed spawning on 11th November.
2. The greatest number spawned in December and January.
3. Spawning ceased early in February.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as a fair average.

Smolts—

1. Smolts were noticed migrating seawards in March, April, and May.
2. As a smolt year 1908 was very good, smolts being of very large size.

REPORT FROM BERVIE DISTRICT.

Take of Fish—

3. Particulars as to the times grilse and sea trout appeared are as follow :—The first grilse was taken in the sea on 23rd May, being a fortnight later than previous years; sea trout were got in abundance in Bervie Bay about 10th June, being about a fortnight earlier than previous years.
4. The weight of the heaviest salmon taken during the season was 41 lbs.

   The particulars of time and place of capture are :—About the end of July, in a bag-net at Shieldhill.

Protection—

1. The assessable rental for 1908 was £910 13s.
2. The sssessment levied was 16½ per cent.
3. The water bailiffs employed are five in number.

The Salmon Disease—

1. Disease made its appearance this year in the month of October, and reached its height in February.

   The river was free of diseased fish in the middle of March.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, - - - - - -	34	22
Clean, - - - - - -	...	1

The Spawning Season—

1. Fish were first noticed spawning on 18th October.
2. The greatest number spawned in the end of November and in December.
3. Spawning ceased about the middle of February.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as having been very good. The river, during most of the spawning season, ran slightly in flood.

Smolts—

1. Smolts were noticed to be migrating seawards in the first week of May up to the middle of July.
2. As a smolt year 1908 was very good.

REPORT FROM DEE DISTRICT.

Take of Fish—

3. Particulars as to the times grilse and sea trout appeared are as follow :—A few sea trout got at opening of season, 11th February, but June and July were the best months for sea trout. First grilse caught on sea coast at Portlethen fishings, on 17th April, by fixed engine. First grilse by sweep net at Bridge of Dee, Aberdeen, on 25th April. First grilse by rod and line at Blackhall Fishery, Banchory-Ternan, on 19th May.
4. The weight of the heaviest salmon taken during the season was 46 lbs.

   The particulars of time and place of capture are :—46 lbs., caught at Harbour Commissioners' fishings by fixed engine on 25th August; 32 lbs., by sweep net in river at Pot fishings, near Aberdeen; 33 lbs., by rod and line in river at Durris, 19th October.

Protection—

1. The assessable rental for 1907-08 was £18,893 16s. 8d.
2. The assessment levied was at the rate of 5½ per cent., yielding £1039 8s. 9d.
3. The water bailiffs employed are 23 in number for the close time, but only four of that number for the whole year.

Pollutions—

1. The existing pollutions are :—At Culter Paper Mills, about eight miles up river. River was seriously polluted by discharge from these mills in March and April and in June and July.

2. Remedial measures :—The pollution by sewerage from the City of Aberdeen has been very considerably lessened since the main sewer referred to in previous reports has been completed and in working order.

The Salmon Disease—

1. Disease made its appearance this year in the month of November 1908, and reached its height at end of December.
   The river was comparatively free of diseased fish early in January, but not yet completely so.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, ...	467	122

The Spawning Season—

1. Fish were first noticed spawning on 25th October (rather later than usual).
2. The greatest number spawned in upper reaches in November ; lower reaches in December.
3. Spawning ceased about middle of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as very good in main river, but poor in tributaries, owing to low water in October and first fortnight in November.

Smolts—

1. Smolts were noticed to be migrating seawards about middle of March.
2. As a smolt year 1908 was considered to be rather poor, but river running high in March and April, so that smolts may have migrated seawards in great numbers without being observed.

Artificial Propagation of Salmon—

Hatchery at Drum has not been used this season.

REPORT FROM DON DISTRICT.

Take of Fish—

3. Particulars as to the times grilse and sea trout appeared are as follow :—First grilse caught 5th May at Nether Don coast fishing—South station ; sea trout, 11th February, at opening of fishing season—most plentiful in June and July.
4. The weight of the heaviest salmon taken during the season was 35 lbs., at Nether Don fishing, by fixed engine in the sea, 12th August ; 28 lbs., by rod and line at Cruives of Don, near Aberdeen, on 8th October.

Protection—

1. The assessable rental for 1908 was £3945 10s.
2. The assessment levied was at the rate of 14 per cent., yielding £552 8s. 3d.
3. The water bailiffs employed are 16 in number during close time ; reduced to 3 in June, July, and August.

Pollutions—

1. The existing pollutions are chiefly mill refuse and sewerage.
2. Remedial measures :—The large sewer that has been in progress for the last three years is now practically completed, but it has not yet been opened. It is expected to be in operation some time during the ensuing summer.

The Salmon Disease—

1. Disease made its appearance this year in the month of December, and reached its height in end of January.
   The river was free of diseased fish in end of March.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, ...	27	23

The Spawning Season—

1. Fish were first noticed spawning on 7th November.
2. The greatest number spawned in December.
3. Spawning ceased practically about end of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as fairly good as regards both the numbers of fish observed and the state of the river, which was medium as regards volume.

Smolts—

1. Smolts were noticed to be migrating seawards in middle of March.
2. As a smolt year 1908 was a good average.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was about 80,000.
2. In securing ova the numbers of male and female fish captured were, respectively, 4 males and 6 females.

Fully 50,000 ova, believed to be successfully hatched, were put into the rivers in June, viz. :—In the Dee. at Crathes and Cults ; and into the Don, at Inverurie and Kintore.

REPORT FROM YTHAN DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 41 lbs.

The particulars of time and place of capture are :—Month of August, in a bag net, at Port Erroll fishings.

Protection—

1. The asseasable rental for 1908 was £1352.
2. The assessment levied was £188.
3. The water bailiffs employed are 4 in number, 1 all the year, with the occasional assistance of 3 others.

Pollutions—

1. The existing pollutions are :—Sewage from the Burgh of Ellon.
3. Remedial measures :—The attention of the Burgh Authorities has been called to the matter.

The Salmon Disease—

1. Disease made its appearance this year in the month of December, 1907, and reached its height in February, 1908.

The river was free of diseased fish in April.

2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, ...	77	25

The Spawning Season—

1. Fish were first noticed spawning on 12th November 1907.
2. The greatest number spawned first week in January.
3. Spawning ceased in January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as very favourable.

Smolts—

1. Smolts were noticed to be migrating seawards in April.
2. As a smolt year 1908 was very good.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was about 70,000.
2. In securing ova the numbers of male and female fish captured were, respectively, 5 female and 8 male salmon.

REPORT FROM UGIE DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
    (*a*) By fixed engine, 900 salmon and 1000 grilse.
    (*b*) By sweep net, 1500 sea trout.
    (*c*) By rod and line, 500 finnock and sea trout and 8 salmon.

   Particulars as to the times grilse and sea trout appeared are as follow :—Grilse made their appearance in May and continued during June, July, and August. Sea trout made their appearance in June and continued during July, August, and September.
4. The weight of the heaviest salmon taken during the season was (1) 42 lbs. by fixed engines, and (2) 24 lbs. by rod and line.

   The particulars of time and place of capture are :—(1) By fixed engines at the mouth of the Ugie, in August 1908 ; (2) in river Ugie, in August 1908.

Protection—

1. The assessable rental for 1908 was £809.
2. The assessment levied was £66 15s. 1d., being at the rate of 1s. 7¾d. per £.
3. The water bailiffs employed are 5 in number—1 regular man who has the assistance of 4 gamekeepers of Colonel Ferguson of Pitfour, when on their beats.
4. Particulars as to prosecutions instituted are briefly as follow :—There was one prosecution, which was against the lessees of the sea fishings at the mouth of the Ugie for contravention of the weekly close time for failure to remove, between Saturday, 18th, and Monday, 20th July 1908, the leaders of three bag-nets. When they drew the nets on the Monday morning there were 28 salmon in them, which they killed and took ashore to their store. A warrant was granted for seizure of the fish, and these were seized. The respondents, however, subsequently admitted the offence and granted a letter to me, as Clerk to the Ugie Board, to this effect, and agreed to forfeit the salmon to the Board and pay all expenses. Their defence was that the weather on the Saturday night was rough and they were unable to remove the nets, and could not get men to work on the Sunday, hence their not being removed until early on Monday morning.

The Salmon Disease—

1. Disease made its appearance this year in the month of October 1907, and reached its height in the end of December 1907.

   The river was free of diseased fish in May 1908.
2. The number of diseased fish taken from the river and destroyed was 25, as follows :—

	Males.	Females.
Kelts, ...	10	15

The Spawning Season—

1. Fish were first noticed spawning on 24th December 1907.
2. The greatest number spawned during the period from the last week of November until the middle of December 1907.
3. Spawning ceased on 1st January 1908.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as a very good one. There was a good stock of spawners forward, the river being favoured with little spates to take them on to the spawning ground.

Smolts—

1. Smolts were noticed to be migrating seawards in the month of April 1908.
2. As a smolt year 1908 was very good. There was a great show of smolt all over the tidal waters in the first and second weeks of May 1908.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was from 50,000 to 60,000.
2. In securing ova the numbers of male and female fish captured were respectively 3 males and 6 females.

REPORT FROM DEVERON DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 44 lbs.
   The particulars of time and place of capture are :—Caught in August near Whitehills.

Protection—

1. The assessable rental for 1908 was £3381 4s.
2. The assessment levied was £387 8s. 7½d.
3. The water bailiffs employed are 11 in number.

Obstructions to the Passage of Fish—

3. Fish passes built or in prospect :—One at Huntly.

The Salmon Disease—

1. Disease made its appearance this year in the month of November, and reached its height in December.
   The river was free of diseased fish in May.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, ...	381	79
Clean, ...	...	2

The Spawning Season—

1. Fish were first noticed spawning on 16th October.
2. The greatest number spawned in November.
3. Spawning ceased at end of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarged as exceptionally good.

Smolts—

1. Smolts were noticed to be migrating seawards on 20th April.
2. As a smolt year 1908 was very good.

REPORT FROM SPEY DISTRICT.

Take of Fish—

3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

Month, 1908.	By Net and Coble.			By Fixed Engine.		
	Salmon.	Grilse.	Trout.	Salmon.	Grilse.	Trout.
Feb. 11th to 28th, .	8·7	—	0·5	3·2	—	0·4
March, ...	10·3	—	1·1	3·6	—	0·5
April, ...	8·2	—	13·1	2·5	—	6·4
May, ...	11·6	0·2	30·3	10·8	0·1	24·8
June, ...	13·2	6·5	35·6	18·5	11·6	33·3
July, ...	20·1	68·6	15·2	16·4	51·8	26·4
August, . . .	27·9	24·7	4·2	45·0	36·5	8·2
	100·0	100·0	100·0	100·0	100·0	100·0

Particulars as to the times grilse and sea trout appeared, as included in above return, are as follow :—

Grilse, ...	9th May.
Trout, ...	11th February.

4. The weight of the heaviest salmon taken during the season was 44 lbs.
The particulars of time and place of capture are :—Sea nets at Portgordon.

Protection—

1. The assessable rental for 1908 was £9243 15s.
2. The assessment levied was £1174 14s. 6d., at 2s. 6½d. per £.
3. The water bailiffs employed are 37 in number, and a superintendent.

The Salmon Disease—

1. Disease made its appearance this year in the month of November, and reached its height in January.
The river was free of diseased fish in June.
2. The number of diseased fish taken from the river and destroyed was 89, as follows :—

	Males.	Females.
Kelts, ...	79	10

The Spawning Season—

1. Fish were first noticed spawning on 19th September 1907.
2. The greatest number spawned in October and November.
3. Spawning ceased at end of March 1908.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as good.

Smolts—

1. Smolts were noticed to be migrating seawards in April, May, and June.
2. As a smolt year 1908 was good.

REPORT FROM LOSSIE DISTRICT.

Protection—

1. His Grace the Duke of Richmond and Gordon contributed voluntarily £76 18s. 7d, and Captain Brander Dunbar £15, to meet expenses for year.
3. The water bailiffs employed are 3 in number, superintended by the River Spey district superintendent.

Obstructions to the Passage of Fish—

4. Natural obstructions not yet dealt with are :—The rocks of Kellas, some four miles beyond Elgin.

The Salmon Disease—

1. Disease made its appearance this year in the month of November, and reached its height in December.
The river was free of diseased fish in June.
2. The number of diseased fish taken from the river and destroyed was 26, as follows :—

	Males.	Females.
Kelts, ...	17	9

The Spawning Season—

1. Fish were first noticed spawning on 8th October 1907.
2. The greatest number spawned during month of November.
3. Spawning ceased by middle of January 1908.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as very good.

Smolts—

1. Smolts were noticed to be migrating seawards in April and May principally.
2. As a smolt year 1908 was good.

REPORT FROM FINDHORN DISTRICT.

Take of Fish—

3. Particulars as to the times grilse and sea trout appeared are as follow :—First grilse caught by fixed engines, 2nd May ; by net and coble in fresh water, 15th May ; main run of grilse in July ; main run of sea trout in June.
4. The weight of the heaviest salmon taken during the season was 40½ lbs.
   The particulars of time and place of capture are :—Burghead, end of July (coast net).

Protection—

1. The assessable rental for 1908 was £3661.
2. The assessment levied was £300.
3. The water bailiffs employed are 3 in number, and 12 additional bailiffs are employed during spawning season.

The Spawning Season—

1. Fish were first noticed spawning on 16th October.
2. The greatest number spawned between 20th October and 25th November.
3. Spawning ceased on the upper reaches by the 28th November ; on the lower reaches not yet done spawning (31st December).
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as below the average. The water during spawning season on the upper reaches was very low. The fish from the lower pools could not get to the upper fords in time for the usual spawning season. They fell back and have spawned lower down.

Smolts—

1. Smolts were noticed to be migrating seawards in April, May, and June.
2. As a smolt year 1908 was about an average.

REPORT FROM NESS DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
   (*a*) By fixed engine, about 12,000.
   (*b*) By sweep net, about 2000.
   (*c*) By rod and line, about 800 salmon and grilse over district.
3. Particulars as to the times grilse and sea trout appeared are as follow :—Grilse appeared as early as April, largest run end of July ; sea trout, July and August.
4. The weight of the heaviest salmon taken during the season was 42 lbs.
   The particulars of time and place of capture are :—Spring ; Garry.

Protection—

1. The assessable rental for 1908 was £3532 15s.
2. The assessment levied was £323 16s. 8d.
3. The water bailiffs employed are 8 in number—1 superintendent, 3 permanent bailiffs and 4 temporary.

The Spawning Season—

1. Fish were first noticed spawning in middle of October.
2. The greatest number spawned in November and December.
3. Spawning ceased at end of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as very good—the river during spawning months being greatly above normal.
   The number of couples counted on each different river in the district :—Garry, 120 couples ; Kingie, 106 couples ; Quoich, 16 couples ; Loan, 42 couples ; Morriston, 28 couples ; Oich, 28 couples ; Eurick, 15 couples ; Eathy, 12 couples ; Ness, cannot say (water in spate during spawning season).
   The above figures are from the different watchers stationed at these rivers during the spawning season.

Smolts—

1. Smolts were noticed to be migrating seawards in May.
2. As a smolt year 1908 was an average.

Artificial Propagation of Salmon—

1. The river has not been netted for spawners for some years.

REPORT FROM CONON DISTRICT.

Take of Fish—

3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
By Fixed Engines, ...	1	7	8	15	17	42	10	...
By Sweep Net, ...	2	6	7	10	11	48	16	...
By Rod and Line, ...	3	25	20	10	14	11	9	8

Particulars as to the times grilse and sea trout appeared, as included in the above return, are as follow :—The first grilse caught was in the Cromarty sweep net fishings on the last day of April. The main run of sea trout is in March and April. Clean sea trout in tidal waters of the Conon at all seasons.

4. The weight of the heaviest salmon taken during the season was 30 lbs. At Hilton bag net fishery.

Protection—

1. The assessable rental for year 15th May 1908 to 15th May 1909 was £2967 10s.
2. The assessment levied was 1s. 4d. per £.
3. The water bailiffs employed are 2 in number—1 permanent inspector and 1 temporary bailiff.

Obstructions to the Passage of Fish—

4. Natural obstructions not yet dealt with are :—Falls of Conon, Falls of Rogie, Falls of Garve, and Falls of Orrin.

The Spawning Season—

1. Fish were first noticed spawning on 24th October.
2. The greatest number spawned from the 5th to the 19th November.
3. Spawning ceased about the middle of December.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as an average one.

Smolts—

2. As a smolt year 1908 was fairly good.

REPORT FROM ALNESS DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 39 lbs. The particulars of time and place of capture are :—Taken by sweep net on the Teaninich fishings, at the mouth of the River Alness, about the end of June.

Protection—

1. The assessable rental for 1908 was £455 15s.
2. The assessment levied was 4s. per £.

3. The water bailiffs employed are 2 in number—1 permanent and 1 a temporary assistant during autumn.
4. No prosecutions.

Pollutions—

1. The existing pollutions :—Some sewerage from the village of Alness at present gets into the river. There is also sewerage from some of the large houses along the river sides, but the water bailiff is not prepared to say that any harm is thereby done to the fishing interests in the river.
2. Remedial measures :—The Local Authorities under the Public Health Acts have formed the villages of Alness and Bridgend into special drainage districts, and steps are to be taken this year to have the sewage from these villages conveyed in a pipe to the sea below Teaninich.

The Spawning Season—

1. Sea trout were first noticed spawning about 10th October, and salmon and grilse about 1st November.
2. The greatest number spawned about the end of November.
3. Spawning ceased generally about the end of December.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as below the average for salmon and grilse, and good for sea trout.

Smolts—

1. Smolts were noticed to be migrating seawards about the middle of April.
2. As a smolt year 1908 was only fair.

REPORT FROM KYLE OF SUTHERLAND DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 38 lbs. The particulars of time and place of capture are :—Bag nets, in August.

Protection—

1. The assessable rental for 1908 was £3333.
2. The assessment levied was £319 8s. 3d.
3. The water bailiffs employed are 16 in number.

The Spawning Season—

1. Fish were first noticed spawning on 5th October.
2. The greatest number spawned in November.
3. Spawning ceased at end of December.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as very good.

Smolts—

1. Smolts were noticed to be migrating seawards in April and May.
2. As a smolt year 1908 was above the average.

REPORT FROM SUTHERLANDSHIRE DISTRICTS (EAST AND WEST COAST)—HELMSDALE, BRORA, FLEET, INVER, INCHARD, KIRKAIG, AND LAXFORD.

Take of Fish—

2. The actual number of fish caught has been as follows :—
    (*a*) By fixed engine (West Coast bag nets)—Salmon, 577 ; grilse, 2186 ; trout, 238.
    (*b*) By sweep net (Brora sweep nets)—Salmon, 329 ; grilse, 386 ; trout, 243.
    (*c*) By rod and line—Brora, 212 ; Helmsdale, upper beats, 207 ; lower beats, 494—701 ; River Inchard and Garbetbeg Loch, 46 ; River Laxford, 43 ; Kirkaig, 10 ; Inver, 31.

3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.
*By Fixed Engine	Salmon,	–	–	·1	1·9	26·0	32·9	36·5	2·6	–
	Grilse,	–	–	–	–	·4	16·0	77·1	6·5	–
	Trout,	–	–	·4	–	10·5	13·0	68·1	8·0	–
†‡By Sweep Net	Salmon,	–	–	10·0	5·7	34·0	26·0	8·1	16·2	–
	Grilse,	–	–	–	–	1·4	50·0	29·3	19·3	–
	Trout,	–	–	–	–	9·2	68·2	22·6	–	–
§By Rod and Line	Salmon, Grilse,	·7	4·5	17·6	17·83	16·7	14·71	15·7	5·56	6·7

* West Coast bag nets. † Brora sweep nets,

‡ Fishing on river suspended till 1st May ; figures shown in March and April arrived at by including fish netted in Loch Brora. § Helmsdale river.

Particulars as to the times grilse and sea trout appeared, as included in the above return, are as follow :—First grilse caught in West Coast bag nets was one of 2 lbs. caught on 8th May, and the next was one of same weight caught on 18th of same month. First grilse caught in Brora sweep nets was a fish of 2 lbs. weight caught on 8th May. Main run of grilse and trout on West Coast appears to be in July, and on East Coast in June.

4. The weight of the heaviest salmon taken during the season was 29½ lbs., on River Helmsdale.

The particulars of time and place of capture are :—Caught 17th April, on Lower Torrish Pool, by Miss Radcliffe, Kildonan.

No return of heaviest fish caught by nets.

Protection—

1. The assessable rental for 1908 was—East Coast £2160, West Coast £1317, but angling mostly let with shootings, and value not fully apportioned.
3. The water bailiffs employed are 5 in number, but all keepers are bound to assist in watching.

The Spawning Season—

1. Fish were first noticed spawning on 12th October.
2. The greatest number spawned in November.
3. Spawning ceased at the end of November and beginning of December.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as an average season on the River Helmsdale, and a poor one on the Brora, where spawning fish were scarce all over the river. Reports from the West rivers show a poor spawning season. On the River Laxford the river during first part of spawning season was so low that the fish could not get to the fords, and during the latter part of the season river in flood. On the Inver and Kirkaig there was too much water during the spawning season, and but few salmon were seen on the spawning beds.

Smolts—

1. Smolts were noticed to be migrating seawards in the second week of April.
2. As a smolt year 1908 was an average.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was 1,490,000.
2. In securing ova the numbers of male and female fish captured were respectively :—On lower part of Helmsdale, 20 per cent. more females ; on higher parts, 4 males to 1 female. Great variation.

Interesting note from Dempster, river bailiff, dated 5th December 1908 :—"As we had 24 marks left over after marking all the fish we had in the ponds, and as Mr. Sykes was anxious to have all 200 marks put in, we were netting Dalcharn Pool to-day to have these marks used up, and in the course of our operations landed two very nice *clean run* salmon of 10 lbs. and 14½ lbs. As I am not aware of clean fish ever having been got there at this season of the year, I think it worth while to let you know. Both fish were marked and returned to the river."

Dalcharn is close to Borrobol, on the Upper Helmsdale.

COUNTY OF SUTHERLAND—NORTH COAST (RIVERS HALLADALE, NAVER, BORGIE, KINLOCH, AND HOPE).

Take of Fish—

2. The actual number of fish caught has been as follows :—
   - (*a*) By fixed engine—388 salmon, 1644 grilse.
   - (*b*) By sweep net—1044 salmon, 2170 grilse.
   - (*c*) By rod and line—510 salmon and grilse.
3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.
By Fixed Engine, .	...	...	...	...	3	27	65	5	...
By Sweep Net, .	...	...	...	...	7	29	63	1	...
By Rod and Line, .	1	3	23	22	17	8	5	8	13

Particulars as to the times grilse and sea trout appeared, as included in the above return, are as follow :—First grilse taken 8th May by sweep net ; first sea trout taken 6th May by bag net.

4. The weight of the heaviest salmon taken during the season was 30 lbs.

The particulars of time and place of capture are :—Caught on 30th July 1908, by sweep net, at mouth of River Halladale.

Protection—

1. The assessable rental for 1908 was £1300 per Valuation Roll, but angling mostly let with shootings and not apportioned at full value.
2. No assessment levied.
3. The water bailiffs employed are 4 in number, in addition to keepers who assist in the watching.

The Spawning Season—

1. Fish were first noticed spawning on 30th October.
2. The greatest number spawned between the 1st and 16th November.
3. Spawning ceased about the end of November.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as not very favourable. Rivers low during spawning time.

Smolts—

1. Smolts were noticed to be migrating seawards in May—a good appearance for about ten days from the 10th of the month.
2. As a smolt year 1908 was fairly good—better than the previous year.

REPORT FROM SLIGACHAN AND SNIZORT DISTRICTS.

Protection—

1. The assessable rental for 1908 was £540.
2. The assessment levied was for a sum of £15 6s. 11d., and was paid in equal proportions by 6 proprietors.
3. The water bailiffs employed are 18 in number.

REPORT FROM LOCHY DISTRICT.

Take of Fish—

3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

		May.	June.	July.	Aug.	Sept.	Oct.
By Rod and Line.	Salmon and grilse,	4·30	9·30	30·98	17·90	25·47	12·04
	Salmon, grilse, and sea trout, ...	1·18	4·34	11·28	47·55	30·88	4·80

Note.—Only one beat fished in May.

4. The weight of the heaviest salmon taken during the season was 43 lbs. The particulars of time and place of capture are :—24th October, in Spean, No. 1 beat (top beat); river very low at time; taken with No. 10 "Thunder and Lightning" fly.

Protection—

1. The assessable rental for 1908 was £2880.
2. No assessment levied.
3. The water bailiffs employed are 11 in number.

The Spawning Season—

1. Fish were first noticed spawning at end of October in small tributaries.
2. The greatest number spawned in November.
3. Spawning ceased on 20th December.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as rather scarce. River mostly too high.

REPORT FROM AWE DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 50 lbs.—male fish.

   The particulars of time and place of capture are :—Caught in bag-net at Dunstaffnage fishing station on July 8th.

Protection—

2. No assessment was levied. It is now about to be levied.
3. The water bailiffs employed are 1 in number, under immediate control of Board. There are some keepers in the district who hold the commission as bailiff from the Board.

The Spawning Season—

1. Fish were first noticed spawning—Sea trout, 16th October ; fine show of spawning sea trout, 20th November ; salmon, 16th November.
2. The greatest number spawned on 14th December.
3. I think salmon spawning will not cease until beginning of January, as a fine show was seen late going up the River Awe.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as a good show of breeding fish. The state of water at the beginning of the spawning season was not too high, but at the height of the spawning season a very heavy flood came which would destroy some of the beds. On the whole, the season should be a fairly good spawning one.

Smolts—

1. Smolts were noticed to be migrating seawards in May, the eighth day—fair show, but late.
2. As a smolt year 1908 was fairly good.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was 45,000.
2. In securing ova the numbers of male and female fish captured were respectively 13 male and 10 female.

REPORT FROM LEVEN AND CLYDE DISTRICT, INCLUDING LOCH LOMOND.

Take of Fish—

1. State whether the take of fish has been above or below the average of previous years.
    - (*a*) By fixed engines in the sea—There are none within this district.
    - *(*b*) By sweep net in the tidal waters of the River Clyde—Above the average.
    - (*c*) By rod and line in Loch Lomond—Above the average for salmon and grilse, below for sea trout, particularly of the smaller class.

   **Note.*—The Association alone nets the Clyde, and that only by two nets on one shot. It does not exercise at all its right of netting the Leven or Loch Lomond. In the latter, four nets are worked by the Duke of Montrose and his tenants, and one by Sir A. W. Leith Buchanan, Bart., at odd times.
2. The actual number of fish caught has been as follows :—
    - (*b*) By sweep net in River Clyde in 3 months—Salmon, 368 ; grilse, 485 ; sea trout, 4090.
    - (*c*) By rod and line (approximately) in Loch Lomond—Figures not available.
3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

		May.	June.	July.
By sweep net.	Salmon,	9	57	34
	Grilse,	0	20	80
	Sea trout,	8	14	78

   Particulars as to the tines grilse appeared, as included in the above return, are as follow :—Sea trout began to run early in April. The first grilse taken was got in the Clyde nets on 19th June.
4. The weight of the heaviest salmon taken during the season was 18 lbs., in Clyde nets, and 21½ lbs. in Loch Lomond.

   The particulars of time and place of capture are not noted for the Clyde fish, but the loch fish was taken on the minnow on 12th May at the mouth of the Endrick.

   Note.—These weights are trivial compared with those of other districts, but the explanation is that for many years the Endrick, the one important salmon river, has been flagrantly poached in the spawning season. An effort is being made this season to enlist the sympathy of the riparian proprietors with a view to having the spawning beds watched.

Obstructions to the Passage of Fish—

4. Natural obstructions not yet dealt with are :—There are no natural obstructions in the Clyde or Leven, but nearly all the tributary streams of Loch Lomond are partially or wholly obstructed by falls.

(1) The Fruin is partially obstructed by a fall, which both salmon and sea trout can ascend, however, in favourable circumstances.
(2) The Finlas is wholly obstructed one mile from the loch.
(3) The Luss is partially obstructed by a mill dam, which sea trout, but not salmon, surmount in favourable circumstances.
(4) The Douglas is wholly obstructed by a fall a quarter of a mile from the loch.
(5) The Inveruglas Water is wholly obstructed by falls.
(6) The Falloch is wholly obstructed two miles from the loch.
(7) The Arklet is wholly obstructed at the loch by a fall.
(8) The Endrick is partially obstructed at the Pot of Gartness, but salmon and sea trout both ascend in favourable states of the water.

Abortive attempts have been made to improve the Douglas, and much benefit would accrue if the proprietors permitted the ascent of the Endrick to be made easier for the fish, which might be done at a very small cost.

Pollutions—

1. The existing pollutions are still flagrant.
    - (1) The Clyde is still badly polluted by Glasgow sewage, though the great purification scheme, now approaching completion, may be expected to remedy matters to an unknown extent. As it is, experimental netting has shown that no salmon or sea trout run above Bowling.
    - (2) The Leven suffers from gross sewage pollution by the town of Dumbarton, a complete system of water closets now carrying the whole town sewage uncleansed into the river, in spite of objections raised by the owners of the fishery. Such a flagrant dereliction of duty by a local authority deserves the severest censure, and it is to be regretted that the Fishery Board possesses no power of initiative to meet such cases. The Leven is also still polluted by domestic sewage carried from the old existing sewers serving the smaller towns on its banks. The County Council of Dumbarton are in this matter responsible, but they have recently shown a disposition to conserve the amenity of the river by inaugurating a complete modern system of purification in connection with large new sewers at Alexandria. The river is still greatly polluted and much discoloured by discharges from the various works on its banks, but the owners have largely endeavoured to meet objections by remedial works, and certainly exercise considerable care lest actively poisonous discharges enter the river. The problem locally is one of much difficulty, because vacant ground once available for settling tanks has been covered by buildings in extending the works to the utmost. The innocuous disposal of waste products ought to be a primary charge upon all industries, but even approximate restoration of the river to its pristine purity would now be a very costly business.

The Salmon Disease—

1. Disease made its appearance this year in the month of December, and reached its height in January.
   The river was free of diseased fish in February.
2. The number of diseased fish taken from the river and destroyed was as follows :—

	Males.	Females.
Kelts, ...	6	12

The Spawning Season—

1. Fish were first noticed spawning—Sea trout, 7th October ; salmon, 28th November.
2. The greatest number spawned—Sea trout, November ; salmon, December.
3. Spawning ceased—Sea trout, December ; salmon, February.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as one of the most favourable that has ever been noted in the district.

Smolts—

1. Smolts were noticed to be migrating seawards in the beginning of May.
2. As a smolt year 1908 was rather below the average.

Artificial Propagation of Salmon—

1. The number of ova secured locally during the past season was 100,000 salmon ova and 130,000 sea trout ova.
2. In securing ova the numbers of male and female fish captured were not noted.

General Observations.

In many respects it cannot be said that the district suffers through the absence of a District Board. The policy of most Boards is necessarily founded upon exclusive and restrictive rights in the interests of the fishing proprietors. The Association has enlisted the sympathy of both proprietors and the public by safeguarding the rights of the former and the privileges of the latter. Their policy is to restrict commercialism in the interests of sport, and as a consequence of restricted netting the stock has increased so greatly that both the nets and the rods reap the benefit. Were the Leven to be cleansed and the Endrick scrupulously guarded it is impossible to estimate how greatly the yield would be increased, but it is safe to say that, for sea trout especially, few waters could in this country compete with Loch Lomond.

REPORT FROM AYR DISTRICT.

Take of Fish—

2. Actual number of fish caught has been as follows :—

The number of fish caught, so far as officially known, was 175, but there is ample reason to believe that the actual number caught was far in excess of that figure.

As the proprietors do not keep an accurate record, or any record at all, of the times when and the actual number of fish caught, it is impossible to give reliable information on the subject. The majority of fish are usually caught in October, but this year the best takes were earlier in the year.

4. The weight of the heaviest salmon taken during the season was 20 lbs., so far as officially known.

The particulars of time and place of capture are :—Caught on Gadgirth water in the second week in July.

Protection—

1. The assessable rental for 1908 was £159 10s.
2. The assessment levied was £159 10s.
3. The water bailiffs employed are two in number.

Obstructions to the Passage of Fish—

3. Fish passes built or in prospect :—In conjunction with the proprietors, the Board during the year built a pass in the lower weir at Catrine, which was a serious obstruction to the passage of salmon. The proprietors of Catrine Cotton Works also inserted a pass in the upper weir, so that the obstructions which formerly existed have now been removed. There is a dam-dyke constructed of wood at Ballochmyle which the Board consider an obstruction to the passage of fish. They are presently negotiating with the proprietors with the view of having a suitable pass erected.

The Spawning Season—

1. Fish were noticed spawning towards the end of November.
2. The greatest number spawned in November and December.
3. Spawning ceased about the middle of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as beyond the average of previous years.

Smolts—

1. Smolts were noticed to be migrating seawards in April and May.
2. As a smolt year 1908 was beyond the average of previous years.

REPORT FROM DOON DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
   - (*a*) By fixed engine, none.
   - (*b*) By sweep net, 28.
   - (*c*) By rod and line, 372.

4. The weight of the heaviest salmon taken during the season was 28½ lbs. The particulars of time and place of capture are :—Captured about five miles from the sea with Devon minnow.

Protection—

1. The assessable rental for 1908 was £511.
2. The assessment levied was at the rate of 9s. per £.
3. The water bailiffs employed are two in number.

Pollutions—

1. The existing pollutions are :—The mill at Skeldon is now practically closed, so that there is little or no effluent discharged into the river from the settling pond there. There are extensive works on the river bank at Waterside, and a good deal of polluting matter finds its way into the river from these works. Some of the burns are also polluted with the washings from the coal taken from adjoining coal pits. The Board endeavour to prevent pollution from these sources as far as possible.

The Spawning Season—

1. Fish were first noticed spawning in October.
2. The greatest number spawned in December.
3. Spawning ceased in the beginning of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as a good one. There was a very large number of spawning fish in the river.

Smolts—

1. Smolts were noticed to be migrating seawards in January.
2. As a smolt year 1908 was a good year.

REPORT FROM GIRVAN DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
   - (*a*) By fixed engine, 720 salmon, 880 grilse, and between 1500 and 1600 trout.
   - (*c*) By rod and line, only a very few salmon were taken, though an average number of sea trout were caught.

   The first salmon was caught in the sea on 7th April 1907.
4. The weight of the heaviest salmon taken during the season was 20 lbs.

Protection—

1. The assessable rental for 1908 was £533 10s.
2. The assessment levied was £26 13s. 6d.
3. One water bailiff.

The Spawning Season—

1. Fish were first noticed spawning in November.
2. The greatest number spawned in November.
3. Spawning ceased about the end of November.

Artificial Propagation of Salmon—

General.—By the Troon (Loch Bradan) Water Order recently approved of by Parliament the lochs at the principal source of the river have been impounded so as to give an average daily supply of 5,000,000 gallons for the purposes of the Order. The Fishery Board at first opposed the Order, but afterwards consented in respect that a clause was inserted therein binding the promoters to run a daily supply of not less than 2,000,000 gallons of the impounded waters into the river.

REPORT FROM STINCHAR DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 41 lbs.

Protection—

1. The assessable rental for 1908 was £400.
2. The assessment levied was £13.

Smolts—

1. Smolts were noticed to be migrating seawards on 15th May.
2. As a smolt year 1908 was very good.

REPORT FROM BLADENOCH DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
   (*b*) By sweep net, 50.
   (*c*) By rod and line, 28.
4. The weight of the heaviest salmon taken during the season was 23½ lbs.
   The particulars of time and place of capture are :—Barhoise Dam, Penninghame Estate water, by sweep net, in May.
   I have not been able to get returns of the fish taken in Lord Galloway's Innerwell stake nets, nor his sweep net fishing, which is let. I understand, however, both had a fair season compared with recent years.

Protection—

1. The assessable rental for 1908 was £326 10s.
2. The assessment levied was 12s. 5d. per £.
3. The water bailiffs employed are 2 in number.
   A heavy assessment was required in connection with legal proceedings *v.* Armstrong & Sons, Ltd., mill owners, Tarff Mills, Kirkcowan.

Obstructions to the Passage of Fish—

3. Fish passes built or in prospect :—Armstrong & Sons have made a pass in their dyke.

The Spawning Season—

1. Spawning season from middle of November to middle of December. No special note taken.
4. As regards numbers of breeding fish, and state of the water, the past season is regarded as indifferent by some, though probably not much different from other years by others.

REPORT FROM CREE DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
   (*c*) By rod and line :—101 salmon and grilse. Sea trout not counted.
3. Expressed as percentages for each month of the season, so as to show the times of greatest run, the figures are :—

	April	May	June	July	Aug.
By Rod and Line (salmon and grilse),	12	37	17	3	31

   Particulars as to the times grilse appeared are as follow :—Grilse appeared in rivers in month of July—very late owing to dry month of June. Appeared in tidal waters about middle of June.

4. The weight of the heaviest salmon taken during the season was—In rivers, 14 lbs. (several of these). Rod and line—salmon do not run to big weight in this water. In tidal waters no returns.
   As there was no outstanding weight secured, there are no particulars of capture of the heaviest salmon.

Protection—

1. The assessable rental for 1908 was £932 10s.
2. The assessment levied was 9d. per £, or £34 19s. 5d.
3. The water bailiffs employed are 3 in number all the year round, and 4 in June, July, August, and September.

Obstructions to the Passage of Fish—

1. Dam dykes disused, built, or in prospect.—None. There is still the obstruction reported last year of water for timber merchant's mill at Minnigaff from the dam dyke on Penkiln Burn.
4. Natural obstructions not yet dealt with are :—On High Cree at Bargrennan Lynn, and on Minnoch (tributary of Cree) at Glencaird Lynn.

The Spawning Season—

1. Fish were first noticed spawning on first week in November.
2. The greatest number spawned during the month of November. Spawning at height about 15th November.
3. Spawning ceased first week of December.
4. Breeding fish are in quantity ; water at time of spawning was very favourable. Unfortunately, the early days of December brought very serious floods. Apart from possible damage done by these latter, the past spawning season is regarded as excellent.

Smolts—

1. Smolts were noticed to be migrating seawards in month of June.
2. As a smolt year 1908 was excellent.

REPORT FROM DEE (SOLWAY) DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 32 lbs. The particulars of time and place of capture are :—Draught net, in July.

Protection—

1. The assessable rental for 1908 was £1231.
2. The assessment levied was 5 per cent.
3. The water bailiffs employed are 15 in number.

The Spawning Season—

1. Fish were first noticed spawning on 12th October.
2. The greatest number spawned on 28th October.
3. Spawning ceased on 28th October.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as fair.

Smolts—

1. Smolts were noticed to be migrating seawards in April and May.
2. As a smolt year 1908 was very poor.

REPORT FROM NITH DISTRICT.

Take of Fish—

2. The actual number of fish caught has been as follows :—
    (*c*) By rod and line—Cannot be ascertained correctly, but, so far as known, 22 salmon.

   Particulars as to the times grilse and sea trout appeared are as follow :—Grilse, about 23rd June ; sea trout, from early in March till end of July. Grilse about the average, sea trout much over the average of last year.
4. The weight of the heaviest salmon taken during the season was 23½ lbs. The particulars of time and place of capture are :—Beginning of November, in Carnsalloch water, by rod and line.

Protection—

1. The assessable rental for 1908-09 was £506 19s. 4d.
2. The assessment levied was 5s. per £.
3. One water bailiff is employed, with about 20 gamekeepers sworn in as special watchers.

Obstructions to the Passage of Fish—

2. Are the bye-laws observed in every case? Observed except in regard to Dalgonar Meal and Saw-Mills, but the proprietor has undertaken to have the dams removed or passes constructed.
3. Fish passes built or in prospect:—Fish passes have, since last year, been constructed at East Cluden and West Cluden Meal Mills.
4. Natural obstructions not yet dealt with are:—In river Cairn at Gribton Saw Mill, known as "Cluden Rocks," which are an obstruction in low water.

Pollutions—

1. The existing pollutions are:—The efflulents from the mills at Dumfries containing dye, which are still unconnected with the sewage system.

The Spawning Season—

1. Fish were first noticed spawning on 28th December.
2. The greatest number spawned first week of January.
3. Spawning ceased end of January.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as exceptionally good.

Smolts—

1. Smolts were noticed to be migrating seawards in May and June.
2. As a smolt year 1908 was good.

REPORT FROM ANNAN DISTRICT.

Take of Fish—

4. The weight of the heaviest salmon taken during the season was 40 lbs. The particulars of time and place of capture are:—Caught in stake net during August.

Protection—

1. The assessable rental for 1908 was £2947.
2. The assessment levied was £442 1s.
3. The water bailiffs employed are 4 in number.

The Spawning Season—

1. Fish were first noticed spawning on 27th December 1907.
2. The greatest number spawned in January 1908.
3. Spawning ceased in the end of February.
4. As regards numbers of breeding fish, and state of the water, the past spawning season is regarded as very satisfactory and fish very numerous.

Smolts –

1. Smolts were noticed to be migrating seawards in the end of April.
2. As a smolt year 1908 was exceptionally good.

APPENDIX II.

RESULTS OF SALMON-MARKING.

With Chart of Recaptures on Coast.

[SIXTH PAPER.]

BY W. L. CALDERWOOD.

Since my last report on this subject, 40 additional recaptures have been made, some of which are of special interest. For the first time since the marking operations commenced I am able to report the case of a salmon which, after having been marked, has been recaptured on two separate occasions. Several recaptures have been made on the coast which further exemplify the general southward migration previously noted. A fish showing exceptional increase of weight in a short interval of time has been recaptured. And a fish showing no increase, and a marked southward movement on the coast, has also to be reported.

The particulars of marking and recapture of all the fish recovered since my last year's report are given in two divisions according as they represent Long or Short Periods of Migration.* There are this year 13 records showing the long period and 27 showing the short period. In every case the fish was marked as a kelt and recaptured as a clean fish or unspawned fish.

LONG PERIOD.

All marks are of Series B unless otherwise stated.

No.	Weight.	Length.	Condition.	Sex.	Date.	Where Caught.
	lbs.	ins.				
7723A	15	36	Kelt.	F.	17 Jan. 1907.	Tay, Kinnaird.
	33½	42½	Clean.		24 July 1908.	Tay estuary, B.T.
8669A	7	33	Kelt.	F.	26 Feb. 1905.	Tay, Delvine.
	29 ?	—	Clean.		11 Aug. 1908.	Tay estuary.
9196A	8½	34½	Kelt.	F.	22 Feb. 1907.	Tay, Edradynate.
	18½	39	Clean.		11 July 1908.	Tay (Lyon).
1396B	6	26	Kelt.	F.	3 Mar. 1905.	Helmsdale.
2797	13½	35¾	Unspawned.		28 Sept. 1906.	Helmsdale.
4679	19½	37½	Unspawned.		29 Sept. 1908.	Helmsdale.
1472	10½	33	Kelt.	F.	25 Jan. 1907.	Tay, Edradynate.
	25	40¾	Clean.		18 Aug. 1908.	Tay estuary, B.T.
1477	9	33	Kelt.	F.	8 Feb. 1908.	Tay, Findynate.
	20½	38½	Clean.		13 Mar. 1909.	Tay, Stanley, B.T.
2023	6	30	Kelt.	F.	28 Feb. 1906.	Naver.
	16½	34	Clean.		28 July 1908.	Armadale, Strathy (in poor condition).
2714	6½	28½	Kelt.	F.	10 Nov. 1906.	Helmsdale, Kinbrace.
	14½	34	Unspawned.		28 Sept. 1908.	Helmsdale.
2981	8½	32½	Kelt.	F.	17 Jan. 1908.	Tay, Edradynate (very silvery).
	23	39½	Clean.		19 Mar. 1909.	Tay estuary, B.T.
3001	13	37	Kelt.	F.	10 April 1907.	Tay Edradynate (diseased).
	29	41¾	Clean.		18 Aug. 1908.	Tay estuary, B.T.
4211	6	27	Kelt.	...	13 Feb. 1908.	Loch Ness.
	13½	34	Clean.		6 Mar. 1909.	Coast 1½ miles W. of Nairn.
4317	12½	35½	Kelt.	...	15 Feb. 1908.	Loch Oich, Ness.
	24½	40	Clean.		18 Mar. 1909.	Loch Ness, Invermoriston.
4394	11	36	Kelt.	...	31 Mar. 1908.	Loch Oich, Ness.
	20	—	Clean.		26 Feb. 1909.	Loch Ness, Fort-Augustus.

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* Short migration in a recaptured fish is when the re-ascent or capture takes place before the end of the season in which the fish was marked as a kelt.

SHORT PERIOD.

No.	Weight.	Length.	Condition.	Sex.	Date.	Where Caught.
	lbs.	ins.				
549B	15	36	Kelt.	F.	12 Feb. 1908.	Deveron, Ardmiddle.
	26	36?	Clean.		7 Aug. 1908.	Coast net, 1 mile N. of Don mouth.
1719	5	27	Kelt.	M.	12 Jan. 1908.	Borgie River.
	9	...	Clean.		18 July 1908.	Sandside nets.
1796D	8½	31	Kelt.	F.	6 April 1908.	Tay, Edradynate (silvery).
	15	34	Clean.		30 July 1908.	Tay estuary, B.T.
1799	10	36	Kelt.	M.	30 Jan. 1908.	Naver, Syre.
	18½	37	Clean.		13 July 1908.	Naver mouth.
2502	2½	21	Kelt.	M.	24 Jan. 1908.	Borgie River.
	5½	26	Clean.		8 July 1908.	Naver mouth.
2531	10	33	Kelt.	F.	13 Feb. 1908.	Naver, Syre.
	19	34	Clean.		1 July 1908.	Naver mouth.
2532	3	22	Kelt.	M.	13 Feb. 1908.	Naver, Syre.
	5-6	25½	Clean.		8 Aug. 1908.	Fish shop, Glasgow (a grilse !).
2969	15	36	Kelt.	M. ?	20 Jan. 1908.	Tummel, E. Haugh.
	24½	38¾	Clean.	F.	17 Aug. 1908.	Tay estuary, B.T.
3207	6½	27	Kelt.	M.	6 Mar. 1908.	Naver, Skelpick.
	12	30½	Clean.		30 June 1908.	Naver mouth.
3212	11	34	Kelt.	M.	9 Mar. 1908.	Naver, Skelpick.
	18½	37½	Clean.		8 July 1908.	Naver mouth.
3213	6	27	Kelt.	F.	9 Mar. 1908.	Naver, Skelpick.
	11	32	Clean.		14 July 1908.	Sandside, Caithness.
3220	8	33	Kelt.	F.	10 Mar. 1908.	Naver, Skelpick.
	13	32?	Clean.		9 July 1908	Naver mouth.
3225	8	30	Kelt.	F.	11 Mar. 1908.	Naver, Skelpick.
	19	38	Clean.		10 July 1908.	Naver mouth.
3238		Partic	ulars lost	by ghilli	e. 1908.	Naver.
	18	36½	Clean.	...	7 July 1908.	Naver mouth.
3239		Partic	ulars lost	by ghilli	e. 1908.	Naver.
	16	34	Clean.	...	30 June 1908.	Naver mouth.
3240		Partic	ulars lost	by ghilli	e. 1908.	Naver.
	9½	30	Clean.	...	3 July 1908.	Naver mouth.
3241		Partic	ulars lost	by ghilli	e. 1908.	Naver.
	16	34½	Clean.	...	7 July 1908.	Naver mouth.
3272	10	27	Kelt.	M.	19 Mar. 1908.	Naver, Syre.
	12½	33	Clean.		2 July 1908.	Naver mouth.
3590	12	36½	Kelt.	...	7 April 1908.	Deveron, Ardmeallie.
	22½	38	Clean.		25 Aug. 1908.	Coast net, 1 mile S. of Don mouth.
3613	22½	44	Kelt.	...	23 Mar. 1908.	Deveron, Netherdale.
	33½	42½	Clean.		19 Aug. 1908.	Port-Gordon sea-net, Spey District.
*3850	9	32	Kelt.	F.	14 Nov. 1907.	Helmsdale, Borrobol.
	10	34	Unspa	wned.	7 Oct. 1908.	Helmsdale, Borrobol Pond
3902	8½	30	Kelt.	F.	14 Nov. 1907.	Helmsdale, Borrobol Pond
	15¾	33½	Clean.		24 July 1908.	Berriedale net.
4105	14	36	Kelt.	...	17 Feb. 1908.	Ness.
	26¼	...	Clean.		11 Aug. 1908.	Clachnaharry, Ness mouth
4157	13½	33½	Kelt.	F.	26 Nov. 1907.	Spean, Roy mouth.
	18	...	Clean.		16 July 1908.	Minard, Loch Feochan.
4265	7¾	32	Kelt.	F.	13 Feb. 1908.	Deveron, Rothiemay.
	13½	...	Clean.		1 July 1908.	Coast at Banff.
4457	8	35	Kelt.	F.	27 Feb. 1908.	Ness, Dochfour.
	23	38	Clean.		19 Aug. 1908.	Cromarty net.
4683	6	28½	Kelt.	F.	14 Nov. 1908.	Helmsdale, Kinbrace.
	5½	...	Clean.		24 Mar. 1909.	Buckpool, coast of Spey District.

* The weight and length were taken after the fish had been kept in the Hatchery Pond till 14th November. Marked 4708 and again liberated.

In considering, first, the sum of the recaptures—the 13 of long period and the 27 of short period—I find that, adding them to similar records already obtained, yields a total of 63 fish of long migration and 81 fish of short migration.

There are, however, a certain number of recaptures made on the coast which cannot be regarded as yielding strictly an indication of the return of the fish to fresh water. I have therefore eliminated all coastal recaptures in order to show actual periods of return to fresh water alone, and have at the same time allocated the fish to their districts of marking. The result is:—

LONG PERIOD.		SHORT PERIOD.	
Tay - - - -	24	Tay - - - -	11
Helmsdale - - -	20	Helmsdale - - -	2
Brora - - - -	8	Brora - - -	7
Naver - - -	0	Naver - - - -	14
Deveron - - -	0	Deveron - - -	4
Borgie - - -	0	Borgie - - -	1
Spey - - - -	2	Spey - - - -	1
Ness - - - -	3	Ness - - - -	0
	57		40

Six clean grilse marked and released in the Kyle of Sutherland and recaptured as salmon in the same district the following season might be added to the short period, making the total 46, *i.e.*, regarding them as grilse kelts in the winter after marking.

Still it is seen that, so far as these records show actual and well-defined return to fresh water from the sea, the majority of instances are in the long period column.

The remarkable thing is that the Helmsdale does not seem naturally to fall into the same category as the Naver, Brora, or Deveron, as one might expect, but approximates to the large river Tay. A considerable number of Helmsdale fish have been taken on the coast showing the short period, or within the limits of the short period. Whether or not further recaptures will alter the present balance remains to be seen. I am inclined to continue marking and to watch results before formulating any positive view either as to the actual facts, the causes of different habits in this respect in different localities, or the practical issues which may emerge therefrom. The actual results of last season are in singular contrast to some data previously obtained. They show in the restricted application already followed:—

Naver, 11 short.	Tay, 7 long and 2 short.
Borgie, 1 short.	Ness, 3 long and 1 short.
Deveron, 2 short.	Helmsdale, 2 long.

a total of 18 short migrations and 11 long. Others, for the past season, are coastal recaptures.

I may now refer to the fish which has been twice recaptured, and which, I may add, is still at large. On 3rd March, 1905, it was first marked on the Helmsdale, a rod-caught kelt of 6 lb., 26 inches long. It apparently did not return to fresh water in 1905, but adopted the long migration, remaining over a winter in the sea. On 28th September, 1906, when the Helmsdale river watchers were netting to procure fish to keep in store for the two hatcheries of the district, the fish was recaptured for the first time. It was by this time 13½ lb., and 35¾ inches long. The fish was in unspawned condition. The original mark had been 1396. This was now changed to 2797, and the fish subsequently allowed to go. Again, it would appear, the fish adopted the long-migration habit. My reason for thinking so is that the examination of the scales shows this, and that other Helmsdale marking records show in almost all cases moderate growth and sometimes quite insignificant growth and increase in weight, especially in cases where fish have been held up in ponds, as this fish was. Compare, for instance, these two typical Helmsdale records :—

821 { 9 lb. : 30 inches : Kelt : F. : 9th November, 1904.
16 lb. : 33½ inches : Clean : F. : 16th May, 1906.

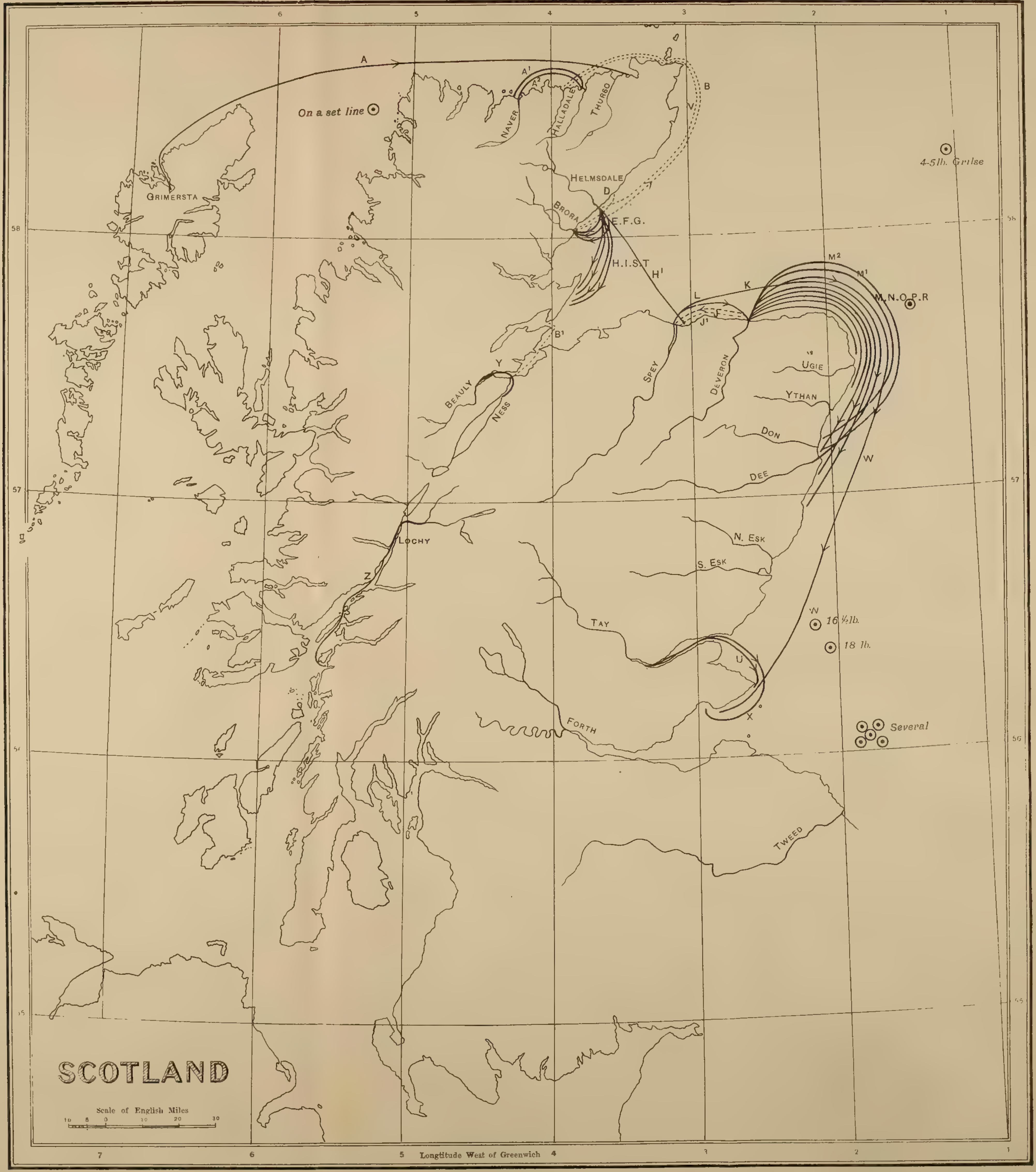
1395 { 7 lb. : 30 inches : Kelt : F. : 3rd March, 1905.
22 lb. : 36 inches : Clean : F. : 26th June, 1906.

After, then, this second period of release in the sea, the fish now bearing Mark No. 2797 was again recaptured in the Helmsdale when the men were netting at the same place for hatching purposes, on 29th September, 1908, *i.e.*, exactly two years since it was last handled, and three years and a half since the fish was first marked. The fish was now marked 4679 and again released. At this second recapture this female fish was again described as in unspawned condition. It weighed 19½ lb., and measured 37½ inches. If, after spawning the second time, the fish lost 4 lb. in weight, as is perhaps approximately correct, we have a nett increase of weight in 3½ years, allowing for one intervening spawing period, of 9½ lb. This is not a great increase. We have had a Tay kelt of 6 lb. recaptured as a clean fish of 19 lb. in fourteen months. Locality exercises a considerable influence on the conditions, however, as has previously been pointed out. Helmsdale, Brora, and Deveron fish do not show very rapid increase. A Helmsdale fish recently caught in the Spey district— in a fixed net near Buckie—is a striking example. The record is :—

4683 { 6 lb. : 28½ inches : Kelt : F. : 14th Nov., 1908. Helmsdale, Kinbrace.
5½ lb. : — — : Clean : F : 24th March, 1909. Buckpool net, Spey district.

The fish may have taken some little time to descend to the sea from Kinbrace after having been marked, and would certainly lose weight during that time. Further enquiries as to its condition when recaptured elicited the reply that the fish " was in rather poor condition, but quite clean."

The scales of this fish show, counting back from the period of its last capture, that it was hatched out in the spring of 1900, went into the sea in 1902 when a smolt, and made its first return to fresh water as a summer fish in 1904, when 4½ years old. In other words, it is an example of the fish which pass through their grilse stage in the sea. In the autumn of 1904 it spawned, and, as we know, was first marked when caught on the rod as a kelt in February, 1905. It was then 5¼ years old. After a visit to the sea, where it remained all summer, winter, and the following spring, it again entered the river in the summer of 1906, when 6½ years old. It was netted in September and kept in a pond till November, when it was, after being stripped, re-marked and again liberated. When it dropped back into the sea as a kelt in the spring of 1907 it was 7¼ years old. Again it adopted the long period of migration, but it re-entered the river very early in 1908, and, so far as we know, remained all season there. In the autumn it was again caught and stripped, re-marked, and returned to the river. It was then 8¾ years old, and may be regarded as a fish which has completed its reproductive function. I do not expect to see it again, but it has yielded us some interesting information in the course of its life, and has reproduced its species on two occasions.



Ordnance Survey, Southampton, 1909

CHART SHOWING MOVEMENTS OF MARKED SALMON WHICH HAVE BEEN RECAPTURED ON COAST. (Letters A-Z.)

———— Southerly and Easterly movements

- - - - - - - - - Northerly movements

⊙ Where Salmon have been caught by fishing vessels

The case of this twice-recaught fish is also of interest as an example of a consistent return to the original river. I have mentioned before now that various indications are not wanting to suggest that transference from one river to another is made by fish under certain conditions as yet little understood. It is remarkable that certain rivers seldom hold large fish, while other rivers commonly do so. From the Helmsdale also not a few fish have migrated southward past the Brora and past the entrance to the Dornoch Firth, and have been recaught south of Tarbet Ness. I regard it as unlikely that such fish would ever return to the Helmsdale. Deveron fish, in the same way, have been repeatedly taken south of the Moray Firth, on the coast of Aberdeenshire, and in one case as far south as the Firth of Forth. The thrice-caught Helmsdale fish shows clearly, however, that other fish will return to their native river with constancy. It is more than likely that this is the most usual condition. Our coastal recaptures point only to a comparatively small percentage of travelling fish—31 instances. The point of interest is that one direction of travel predominates.

I am able in this report to introduce a chart showing the movements of fish which have been recaptured on the coast. The chart was prepared for my last year's report, but by some unexplained oversight the report appeared without the chart. Only two additional lines are added to it, viz., one representing the case just referred to of the Helmsdale fish recaptured on the coast of the Spey district; the other (Z) on the West Coast—the case of a fish which I marked in the Spean, at the mouth of the Roy, on 26th November, 1907. It was recaught at Minard, at the mouth of Loch Feochan, on 16th July, 1908. It had added 4½ pounds to its weight in the interval. The line representing the migration from the Deveron to Elie Ness, in the Firth of Forth, marks the longest distance travelled by any recaptured fish to date. The distance is 150 miles, being rather longer than the Grimersta to Castletown fish (Line A). The dotted lines on the chart represent migrations in a northward direction. There are six such movements, compared with twenty-five southward or eastward movements.

The following records refer to the recaptures shown on the chart. The circular markings on the chart at a distance from the land show approximately where salmon have been captured by fishing vessels :—

Reference to Chart.

Line A—Kelt marked in the Grimersta, W. Lewis.
Recaught in five months at Castletown, near Thurso.
Described still as a kelt.
Line A^{1}—Kelt marked in Borgie.
Recaught at Sandside, Caithness.
Line A^{2}—Kelt marked in Naver.
Recaught at Sandside, Caithness.
Line B—Kelt marked in Brora.
Recaught in Bighouse Bay, Pentland Firth, 100 miles N. and W.
Line B^{1}—Kelt marked in Ness.
Recaught in Cromarty nets.
Line D—Kelt marked in Brora.
Recaught at Berriedale.
Lines E, F, and G—Three Helmsdale fish recaptured in the Brora.
Lines H, I, S, and T—Four Helmsdale fish recaptured at Portmahomack, S. of Tarbet Ness.
Line H^{1}—A Helmsdale fish recaptured in 4½ months at Buckpool, Spey District.
Lines J and J^{1}—Two Deveron fish caught to the west near or at the mouth of the Spey.
Lines K, L, M, M^{1}, M^{2}, N, O, P, Q, and R—Ten Deveron fish which have passed eastwards out of the Moray Firth, and were recaptured on the coasts of Aberdeen and Kincardine shires.
Line W—A Deveron fish which in four months travelled from the Forglen Water, 8 or 9 miles up river, to Elie Ness, in Firth of Forth. The distance is 150 miles, and is the furthest as yet obtained.

LINES U AND X—Two Tay fish, one recaught at Fife Ness, the other in Largo Bay, Firth of Forth.

LINE Y—A clean fish marked in December, 1907, in the Beauly, 1½ miles up river. Recaptured at Dochfour, River Ness, in three months, a clean fish of rather less weight. This is the only example of a fish marked when clean changing its river.

LINE Z—A kelt marked in the Spean at Roy mouth.
Recaptured at Minard, Loch Feochan.

There are one or two special cases which I may now refer to. I have included in the complete list at the commencement of this paper No. 8669A as having been recovered on 11th August 1908. The fish was marked in the Tay at Delvine on 26th Feb. 1905, a 7 lb. kelt, measuring 33 inches. There is no absolute proof that this fish was actually recovered, but the presumption is very strong. The mark itself was found by one of a crew of Tay fishermen on the "hailing ground" of Pyeroad Fishing Station. On the same day a fish was noticed in the ice-house of the Tay Fisheries Co., Perth—to which all fish from Pyeroad Station are sent—from the dorsal fin of which a mark had quite evidently been recently torn. The men in the ice-house have recovered many marks and examine all fish carefully. So convinced were they that the mark had quite recently come out that the fish-box in which this and other fish had arrived was diligently searched for the missing mark. The fish weighed 29 lbs.

There is another recapture concerning which some ambiguity exists. It is not referred to in the list. On 8th August Messrs. Joseph Johnston & Sons, Montrose, wrote me that at Carnoustie on 6th August a marked salmon had been taken in one of their bag-nets. I was informed that the men "tied a piece of string to the tail when sending "their salmon here, but although the fish was examined here, the wire "could not be seen, and we could not find any reason for the string being "tied to the tail; the wire must have dropped out in the box." The fish weighed 18 lb. This seemed to me a capture of special interest. The reference to the wire suggested that the fish had been one of the smolts marked by wire in the dorsal fin in 1905 in the Tay. Further enquiries elicited the information from Edwin Duncan, Messrs. Johnston's foreman at Carnoustie, that the fish "was marked by a small piece of wire drawn into "the dorsal fin." This exactly harmonised with the idea that the fish had been marked as a smolt. A further note from Duncan, when I still pressed for particulars, completely dispelled this view, however. He wrote to Messrs. Johnston as follows:—"All the information I can give is that "the wire had a small label attached to it; the men could see no mark on "it. It was attached to the small fin on the back nearest the tail." The chances are, therefore, the fish had been marked as a kelt at Edradynate, in the Upper Tay, where Mr. H. W. Johnston has been attaching the ordinary marks to the adipose fin with good results.

When referring to the smolt marking of 1905, I may state that while the return of grilse, small spring fish, and summer fish of 1906 have been reported, later recaptures made by the Tay Fisheries Company in 1907 and 1908, which I am aware have been made and concerning which I have heard a good deal, have not been communicated to me by Mr. Malloch, the managing director. After repeated enquiries I am informed the reason is connected with the commercial interests of the Company. I extremely regret that for the present I cannot communicate these interesting recaptures. I trust that on a later occasion Mr. Malloch will yet furnish me with the authenticated information.

It is remarkable that from the Naver four consecutive numbers should have been recaptured in the nets at the mouth of the river, and that the ghillie who marked those fish lost the particulars of each of them. The labels were returned to me by the foreman of the net fishers at Bettyhill.

INCREASE OF WEIGHT.

Two Naver kelts, 3220 and 3225, were 8 lbs. in weight. Each was marked in March and recaptured in July. Both were marked at Skelpick. The former put on 5 lbs., the latter 11 lbs., in the four months. These two cases furnish an excellent example of the variation which occurs. The Deveron-marked fish, No. 549, has, like the latter of the two Naver fish mentioned, put on 11 lbs., but it has taken six instead of four months to do so. The greatest increase of the year is in No. 4457. This Ness fish was 8 lbs. when marked as a kelt at Dochfour on 27th February By 19th August, when it was taken in one of the Cromarty nets of Messrs. G. Paterson & Sons, it had attained the weight of 23 lb., an increase of 15 lb. in practically 5½ months (173 days). The length of the fish in its kelt condition should be noted. A kelt of 35 inches should weigh about 12 lb. It is more than likely, therefore that, when marked, the fish was in specially poor condition, and had spent a considerable time as a kelt in Loch Ness before dropping back into the river. It should be recollected that our marking has repeatedly shown that kelts in fresh water lose weight although they "mend" in general condition. The increase stated, being for a fish of short period in the sea, is very remarkable. The more usual increase for this interval of time is 6 to 7 lbs.

There are also two or three fish which show the opposite extreme, either very small increase or none at all. A really singular little fish is the Borgie-marked kelt 2502. At time of marking it is recorded as only 2½ lb., and was then, we may conclude, a lean grilse kelt. It is also a male, and male grilse kelts are, in our experience, not easily found owing to the rapidity with which they appear to leave fresh water. In 165 days the fish was caught in the nets at the mouth of the Naver, a little salmon of 5½ lb. weight, 26 inches in length—a fish smaller than the average Tay grilse.

Another curious case was recovered only after the fish was exposed for sale in a Glasgow fish-shop. This fish was marked in the Naver as a kelt —presumably a grilse kelt—of 3 lb. It is noteworthy that again this small fish is a male. In 176 days, when in the Glasgow fish-shop, it is described as a clean *grilse* of 5 lb. 6 oz., but having already spawned, it should have been described as a salmon. The place of capture could not be determined. The case of the Helmsdale fish recaught on the coast of the Spey District has already been mentioned. When recaptured the weight was recorded as half a pound less than the kelt weight. By way of extreme contrast these three short-period fish might be compared with the Ness-Cromarty fish of exceptional increase.

2½ lb. Borgie kelt in 165 days = 5½ lb. fish.
3 lb. Naver kelt in 176 ,, = 5 lb. 6 oz. ,,
6 lb. Helmsdale kelt in 131 ,, = 5½ lb. ,,
8 lb. Ness kelt in 173 ,, = 23 lb. ,,

SEA TROUT.

A sea trout recapture is reported from Loch Lomond district which, like one or two others from the same neighbourhood, shows a singularly exact homing tendency. The record is :—

917 { 3·2 : 21 inches : M. : Unspent : 3 Nov. 1906 : Finglas Water.
917 { 6·8 : 26 inches : M. : Unspent : 26 Feb. 1909 : Finglas Water.

KELTS.

Four recaptures of kelts, as kelts, have been made from the Ness District, which, while unfortunate in depriving us of chances of more valuable recaptures, are of some slight interest as showing the course followed by certain fish from the Ness. Although the recaptures were made in the sea in each case, the decline in weight noticeable in kelts recaptured as kelts is quite distinct, indicating that the time occupied in getting clear away from the mouth of the river was probably not great. Three of the fish have gone along the Black Isle shore, northwards, and were caught in the Cromarty nets outside the Suitors of Cromarty ; the other was caught near Nairn. The decrease in weight varies from ½ lb. to 2 lbs.

APPENDIX III.

REPORT ON A MALE KELT, KEPT FOR A YEAR IN FRESH WATER, AND FOUND TO BE AGAIN RIPE FOR SPAWNING.

In a letter from Mr. Thomas Pilkington, of Sandside, Caithness, dated 2nd November, 1908, I received information respecting this remarkable fish. At Sandside Mr. Pilkington has formed several ponds in connection with his hatchery. Towards the end of the fishing season salmon are from time to time taken from the Sandside coast nets and transferred to the ponds, where they are held up till ripe, when they are stripped and allowed to return to the sea by a neighbouring burn. In the letter referred to Mr. Pilkington writes:—

"Last year, when we were spawning our fish, a male grilse which had "had the milt taken from it was overlooked and left in the small catchpit, "and is there now! He is quite fit apparently, and has his proper "quantity of milt, and as seen under the microscope it appears to be "perfectly good, and we shall hope to make use of it when we get some "ova."

That a salmon, without visiting the sea after spawning and obtaining there the store of nourishment upon which the growth of the genitalia so largely depends, should be able again to reproduce its species, seemed to me so remarkable that I at once wrote asking Mr. Pilkington if he would be good enough to allow an analysis of the fish to be made. At the same time I communicated with Professor Noël Paton, to whom one naturally turns for all information respecting the physiology of the salmon. The result was that the fish was shortly afterwards sent direct to Glasgow University, where Professor Noël Paton very kindly investigated the matter.

In agreeing to send the fish, Mr. Pilkington further stated by letter of 13th November—"We spawned some fish yesterday and milted from this "fish 500 ova, which we are keeping apart . . .

"The catch-pit in which this fish was accidentally left last year (*after* "he had been milted) was only about 12 feet by 6 feet at the outside, and "there would not generally be more than a foot of water in it, with very "little of a stream from the burn, and during the summer only the "merest trickle."

The ova fertilised by the milt of this fish developed quite normally.

With regard to the weight of this fish, I am able to compare kelt-weights of similar length from the same locality, since for some years Mr. Pilkington has had his impounded fish marked before they are set at liberty. I give the following series of *male kelts* of somewhat similar length:—

28 inches,	5¼lb.	27 inches,	4½lb.
28 ,,	5¼lb.	27 ,,	4¾lb.
29 ,,	6½lb.	27 ,,	5 lb.
29½ ,,	5½lb.	27 ,,	4½lb.
28 ,,	6 lb.	27 ,,	5 lb.
28 ,,	7½lb.	27 ,,	5¼lb.

It is clear, therefore, that the fish when thus ripe still corresponded in weight to the kelt condition.

W. L. CALDERWOOD.

REPORT BY D. NOËL PATON.

In November 1908, Mr. W. L. Calderwood asked me if I would examine a salmon which had remained for twelve months in a catch-pit from a fish pond without any possibility of procuring food. I very willingly consented to do so, and on November 18th I received the fish, the photograph of which is given on the opposite page.

It had the appearance of a very thin male kelt.

Length - - -	72cm. (28½ inches)
Girth - - - -	28cm.
Depth - - -	12·5cm.
Weight - - -	2450 grms. (fully 5lb.)

The muscles were pale, but of a distinctly pink colour. The stomach was empty and shrunken. The gall bladder was empty. There was no fat on the pyloric appendages. In the lower bowel there was some dark brown mucus. The testes weighed 36·5 grms. In order to compare the condition of the organs with our previous results ("Report on Investigations on the Life History of Salmon" [C. 8787], 1898, p. 6), the weight of the fish was calculated as per "fish of standard length," 100cm. This is 6,488 grms., and the testes, expressed as for per fish of standard length, weighed 96·6 grms. They were therefore considerably heavier than the testes of upper water fish in July and August, and approached in weight the testes of upper water fish in October and November. They had the appearance of being partly shed, and Mr. Calderwood stated that the fish had been used for impregnating ova before it was killed.

The weight of this fish in proportion to its length was less than that of any of the female kelts previously examined by me, the average of 23 such kelts being 7,755 grms. (*loc. cit.*, p. 74), as against 6,488 grms. for the present fish. Although I have tried for several years, I have never succeeded in procuring a male kelt for examination.

Unfortunately, I did not determine the total weight of muscle, but the usual samples of "thick" and "thin" were taken for analysis. The analyses were made for me in the Laboratory of the Royal College of Physicians of Edinburgh by Mr. Alfred Patterson, who had carried out similar analyses in my previous series of observations. He reports as follows:—

MUSCLE: THICK.	Per Cent.
Fat - - - -	*Analysis lost.*
Dry Residue after extraction of Fat - -	17·13
Nitrogen in Dry Residue -	2·56
Protein calculated from Nitrogen - - -	16·00

MUSCLE: THIN.	Per Cent.
Fat - - - - -	1·85
Dry Residue after extraction of Fat - -	15·33
Nitrogen in Dry Residue -	2·28
Protein calculated from Nitrogen - - -	14·25

A comparison of the results of these analyses with my previous series show that the muscle of this fish is extraordinarily poor in fat, but not markedly poor in proteins.

The following table gives a comparison of the percentage composition of the flesh of this fish compared with the average percentage composition of *female* kelts previously examined by me:—

	PRESENT FISH.	AVERAGE OF KELTS ♀.
Solids.		
Thick	19?	21·28 (p. 91).
Thin	17·2	21·65 (p. 91).
Fat.		
Thick—*Analysis lost.*		2·43 (p. 105).
Thin	1·85	4·02 (p. 105).
Nitrogen as measure of Protein.		
Thick	2·56	2·94 (p. 137).
Thin	2·58	2·74 (p. 137).

The chief point of interest in these observations is the demonstration that, without returning to the sea and feeding, the male salmon is able not merely to live through so many months, but actually to develop the seasonal sexual change, and that it still retains in the muscles material sufficient for the complete development of the testes.

APPENDIX IV.

LIST OF SCOTTISH SALMON SEALED, EITHER IN SCOTLAND OR ENGLAND, BY THE OFFICERS OF THE FISHMONGERS COMPANY OF LONDON, SEASONS 1906-07 AND 1908-09.

I am indebted to the Fishmongers Company for a note of all salmon sealed by their officers as a guarantee that they may be legally sold from cold storage during annual close time. From the lists for the two seasons referred to, I have abstracted the following particulars respecting Scottish salmon:—

	1906–07.	1908–09.
At Aberdeen	637	318
Dundee	20	—
Edinburgh	65	192
Leith	1	—
Glasgow	53	388
London	258	78
Liverpool	—	100
Hull	35	98
Leicester	12	5
Southampton	—	73
	1,081	1,252

A summary of the totals from all sources for last season is:—

Scottish	1,252
English	4
Irish	2
Canadian	5,565
British Columbian	1,248
Siberian	4,132
	12,203

APPENDIX V.

RATEABLE VALUE OF SALMON FISHERIES, IN DISTRICTS WHERE BOARDS HAVE BEEN FORMED, FOR THE YEARS 1881 TO 1908 INCLUSIVE.

YEAR.	Alness.		Annan.		Awe.		Ayr.		Balgay.		Bervie.		Conon.		Cree.		Dee (Aberdeen).		Dee (Solway).	
	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Average for 5 years, 1881 to 1885	–	–	–	**1,729**	–	–	–	–	–	–	–	–	–	–	–	**546**	–	**10,127**	–	**1,201**
Average for 5 years, 1886 to 1890	–	–	–	**2,022**	–	–	–	–	–	–	–	–	–	–	–	**532**	–	**11,773**	–	**1,568**
1891	–	–	2,112	–	701	–	–	–	40	–	586	–	2,560	–	530	–	11,968	–	1,463	–
1892	–	–	2,099	–	718	–	–	–	40	–	586	–	2,756	–	530	–	12,336	–	1,463	–
1893	–	–	2,165	–	723	–	–	–	40	–	586	–	2,975	–	544	–	13,911	–	1,463	–
1894	579	–	2,778	–	723	–	–	–	40	–	536	–	2,944	–	554	–	14,489	–	1,463	–
1895	584	–	2,793	**2,389**	896	**752**	–	–	20	**36**	536	**566**	2,540	**2,755**	554	**542**	14,593	**13,461**	1,633	**1,497**
1896	584	–	3,182	–	896	–	–	–	20	–	1,071	–	2,455	–	571	–	15,820	–	1,603	–
1897	614	–	3,182	–	878	–	–	–	20	–	1,071	–	2,590	–	571	–	16,176	–	1,633	–
1898	608	–	3,182	–	878	–	100	–	20	–	871	–	2,554	–	696	–	17,468	–	1,603	–
1899	609	–	3,182	–	870	–	110	–	42	–	871	–	2,554	–	696	–	17,427	–	1,603	–
1900	610	**605**	3,182	**3,182**	870	**878**	110	–	20	**24**	871	**951**	2,504	**2,521**	696	**646**	18,989	**17,176**	1,603	**1,609**
1901	606	–	3,196	–	936	–	110	–	20	–	910	–	3,142	–	696	–	19,419	–	1,596	–
1902	601	–	3,197	–	936	–	110	–	20	–	910	–	3,141	–	696	–	19,455	–	1,557	–
1903	617	–	3,197	–	1,052	–	110	–	40	–	910	–	3,108	–	691	–	18,393	–	1,556	–
1904	617	–	3,197	–	1,129	–	110	–	40	–	911	–	2,975	–	695	–	19,079	–	1,556	–
1905	735	–	3,256	–	1,208	–	110	**110**	40	**32**	911	**910**	3,047	**3,082**	728	**700**	19,333	**19,133**	1,570	**1,553**
1906	531	–	3,006	–	1,306	–	110	–	40	–	911	–	3,047	–	868	–	19,068	–	1,570	–
*1907	530	–	3,256	–	1,467	–	125	–	40	–	910	–	3,004	–	935	–	18,940	–	1,556	–
*1908	455	–	2,947	–	–	–	159	–	–	–	910	–	2,967	–	932	–	18,893	–	1,231	–

* Assessed Rentals.

APPENDIX V.—*continued.*

RATEABLE VALUE OF SALMON FISHERIES, IN DISTRICTS WHERE BOARDS HAVE BEEN FORMED, FOR THE YEARS 1881 TO 1908 INCLUSIVE.

YEAR.	Deveron.		Don.		Doon.		Esk (North).		Esk (South).		Findhorn.		Forth.		Girvan.		Kyle of Sutherland.		Lochy.		Nairn.	
	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Average for 5 years, 1881 to 1885 ...	–	**2,477**	–	**3,247**	–	–	–	**6,211**	–	**2,431**	–	**3,617**	–	**3,868**	–	**571**	–	**2,496**	–	**1,658**	–	–
Average for 5 years, 1886 to 1890 ...	–	**1,807**	–	**3,806**	–	–	–	**6,673**	–	**3,055**	–	**3,570**	–	**4,261**	–	**547**	–	**2,598**	–	**1,719**	–	–
1891	2,047	–	3,646	–	–	–	6,476	–	3,012	–	3,541	–	3,890	–	542	–	2,640	–	1,895	–	1,543	–
1892	2,071	–	3,623	–	–	–	6,519	–	3,012	–	2,501	–	3,704	–	542	–	2,665	–	1,961	–	1,343	–
1893	2,073	–	3,964	–	–	–	6,609	–	3,012	–	3,491	–	3,765	–	542	–	2,613	–	1,961	–	1,343	–
1894	2,138	–	3,743	–	–	–	6,812	–	3,002	–	3,501	–	3,806	–	554	–	2,658	–	2,122	–	1,343	–
1895	2,383	**2,142**	3,583	**3,711**		–	6,812	**6,645**	3,149	**3,037**	3,501	**3,507**	3,766	**3,786**	544	**544**	2,611	**2,637**	2,122	**2,012**	1,136	**1,341**
1896	2,360	–	3,390	–	–	–	6,519	–	3,149	–	3,446	–	3,617	–	500	–	2,634	–	2,094	–	1,136	–
1897	2,469	–	3,383	–	–	–	6,540	–	3,149	–	3,436	–	3,616	–	524	–	2,731	–	2,115	–	1,135	–
1898	2,658	–	3,374	–	–	–	6,579	–	3,507	–	3,436	–	3,738	–	524	–	2,771	–	2,115	–	1,136	–
1899	2,979	–	3,430	–	–	–	6,523	–	3,424	–	3,436	–	3,792	–	524	–	2,838	–	2,020	–	1,136	–
1900	3,078	**2,708**	3,336	**3,382**	–	–	6,414	**6,515**	3,492	**3,342**	3,511	**3,453**	3,801	**3,712**	544	**523**	2,845	**2,763**	2,338	**2,130**	1,136	**1,136**
1901	3,186	–	3,691	–	473	–	6,510	–	3,492	–	3,527	–	3,925	–	514	–	2,890	–	2,992	–	1,136	–
1902	3,048	–	3,700	–	473	–	6,466	–	3,567	–	3,527	–	3,928	–	528	–	3,132	–	2,306	–	1,139	–
1903	3,105	–	3,646	–	486	–	6,494	–	3,552	–	3,587	–	3,731	–	553	–	2,523	–	2,300	–	1,139	–
1904	3,387	–	3,863	–	498	–	6,494	–	3,565	–	3,607	–	3,510	–	544	–	3,517	–	2,238	–	1,141	–
1905	3,369	**3,219**	4,153	**3,810**	498	**485**	6,489	**6,490**	3,590	**3,553**	3,661	**3,581**	3,513	**3,721**	549	**537**	3,515	**3,115**	2,231	**2,413**	1,219	**1,154**
1906	3,425	–	4,173	–	498	–	6,486	–	3,600	–	3,681	–	3,274	–	544	–	3,458	–	2,231	–	1,204	–
*1907	3,381	–	4,035	–	490	–	6,490	–	3,351	–	–	–	3,178	–	541	–	3,408	–	2,231	–	–	–
*1908	3,381	–	3,945	–	511	–	6,474	–	3,674	–	3,661	–	3,569	–	533	–	3,333	–	2,880	–	–	–

* Assessed Rentals.

APPENDIX V.—*continued.*

RATEABLE VALUE OF SALMON FISHERIES IN DISTRICTS WHERE BOARDS HAVE BEEN FORMED, FOR THE YEARS 1881 TO 1908 INCLUSIVE.

YEAR.	Ness.		Nith.		Skye.		Spey.		Stinchar.		Tay.		Torridon.		Tweed.		Ugie.		Ythan.	
	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.	Annual value.	Average value for each period of 5 years.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Average for 5 years, 1881 to 1885 ...	–	**3,093**	–	**520**	–	–	–	**9,165**	–	–	–	**19,596**	–	–	–	**13,600**	–	**335**	–	**746**
Average for 5 years, 1886 to 1890 ...	–	**3,203**	–	**464**	–	–	–	**10,207**	–	–	–	**20,504**	–	–	–	**14,158**	–	**314**	–	**834**
1891	3,366	–	443	–	–	–	9,669	–	–	–	17,820	–	40	–	14,414	–	358	–	931	–
1892	3,254	–	423	–	–	–	9,687	–	–	–	17,227	–	40	–	14,746	–	358	–	1,004	–
1893	3,253	–	756	–	–	–	9,687	–	–	–	19,008	–	40	–	14,573	–	358	–	1,004	–
1894	3,468	–	775	–	–	–	9,316	–	–	–	21,763	–	40	–	15,583	–	356	–	1,004	–
1895	3,209	**3,310**	771	**633**	–	–	9,588	**9,589**	–	–	19,587	**19,079**	20	**36**	15,803	**15,023**	402	**366**	1,024	**993**
1896	3,085	–	815	–	–	–	8,671	–	–	–	17,091	–	20	–	15,084	–	503	–	1,024	–
1897	3,503	–	780	–	–	–	9,638	–	–	–	17,211	–	20	–	15,444	–	504	–	1,294	–
1898	3,667	–	781	–	–	–	10,634	–	–	–	17,905	–	20	–	15,239	–	508	–	1,299	–
1899	3,510	–	775	–	–	–	11,633	–	–	–	21,048	–	20	–	15,000	–	768	–	1,299	–
1900	3,647	**3,482**	676	**765**	424	–	10,122	**10,119**	200	–	22,482	**19,147**	20	**20**	15,032	**15,159**	845	**625**	1,317	**1,246**
1901	3,582	–	654	–	540	–	8,608	–	400	–	22,549	–	20	–	15,005	–	839	–	1,398	–
1902	3,636	–	545	–	540	–	8,052	–	400	–	22,608	–	20	–	15,005	–	839	–	1,398	–
1903	3,516	–	554	–	540	–	8,147	–	400	–	22,648	–	40	–	15,338	–	812	–	1,389	–
1904	3,404	–	584	–	540	–	7,397	–	400	–	22,902	–	40	–	15,389	–	779	–	1,359	–
1905	3,646	**3,556**	583	**583**	540	**540**	8,365	**8,113**	400	**400**	23,069	**22,794**	40	**32**	15,450	**15,247**	778	**809**	1,369	**1,382**
1906	3,503	–	619	–	540	–	8,741	–	400	–	22,676	–	40	–	15,732	–	779	–	1,354	–
*1907	3,502	–	510	–	540	–	8,990	–	400	–	23,202	–	–	–	15,732	–	776	–	1,354	–
*1908	3,532	–	506	–	540	–	9,243	–	400	–	23,508	–	–	–	16,093	–	809	–	1,352	–

* Assessed Rentals.

APPENDIX VI.

ANNUAL CLOSE TIME APPLICABLE TO THE SALMON RIVERS IN SCOTLAND.

N.B.—Observe that, in the following List, the days fixing the commencement and termination of the Annual Close Time for Net-fishing and for Rod-fishing, respectively, are in all cases inclusive, as in the case of the Add, the first river in the List.

Name of River.	Annual Close Time for Net-fishing.	Annual Close Time for Rod-fishing.
Add,	From Sept. 1 to Feb. 15, both days inclusive.	From Nov. 1 to Feb. 15, both days inclusive.
Aline,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Alness,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Annan,	From Sept. 10 to Feb. 24.	From Nov. 16 to Feb. 24.
Applecross,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Arnisdale (*Loch Hourn*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Awe,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Aylort (*Kinloch*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ayr,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Baa and Goladoir,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Badachro and Kerry (*Gairloch*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Balgay and Shieldag,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Beauly,	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Berriedale,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Bervie,	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Bladenoch,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Broom,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Brora,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Carradale (*in Cantyre*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Carron,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Clayburn, Finnisbay, Avennangeren, Strathgravat, North Lacastile, Scalladale and Mawrig (*East Harris*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Clyde and Leven,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Conon,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Cree,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Creed or Stornoway, and Laxay (*Island of Lews*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Creran (*Loch Creran*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Croe and Shiel (*Loch Duich*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Dee (*Aberdeenshire*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Dee (*Kirkcudbright*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Deveron,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Don,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Doon,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Drummachloy or Glenmore (*Isle of Bute*),	From Sept. 1 to Feb. 15.	From Oct. 16 to Feb. 15.
Dunbeath,	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Earn,	From Aug. 21 to Feb. 4.	From Nov. 1 to Jan. 31.
Eckaig,	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Esk, North,	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Esk, South,	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Ewe,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.

Name of River.	Annual Close Time for Net-fishing.	Annual Close Time for Rod-fishing.
Fincastle, Meaveg, Ballanachist, South Lacastile, Borve, and Obb (*West Harris*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Findhorn,	From Aug. 27 to Feb. 10.	From Oct. 11 to Feb. 10.
Fleet (*Sutherlandshire*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Fleet (*Kirkcudbrightshire*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Forss,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 24.
Forth,	From Aug. 27 to Feb. 10.	From Oct. 16 to Jan. 14.
Fyne, Shira, and Aray (*Loch Fyne*),	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Girvan,	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Glenelg,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Gour,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Greiss, Laxdale, or Thunga,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Grudie or Dionard,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Gruinard and Little Gruinard,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Halladale, Strathy, Naver, and Borgie,	From Aug. 27 to Feb. 10.	From Oct. 1 to Jan. 11.
Helmsdale,	From Aug. 27 to Feb. 10.	From Oct. 1 to Jan. 10.
Hope and Polla or Strathbeg,	From Aug. 27 to Feb. 10.	From Sept. 11 to Jan. 11.
Howmore,	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Inchard,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Inner (*in Jura*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Inver,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Iorsa (*in Arran*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Irvine and Garnock,	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Kannaird,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kilchoan or Inverie (*Loch Nevis*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kinloch (*Kyle of Tongue*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kirkaig,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kishorn,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Kyle of Sutherland,	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Laggan and Sorn (*Island of Islay*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Laxford,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Leven,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Little Loch Broom,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Lochy,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Loch Duich,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Loch Luing,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Loch Roag,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Lossie,	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Luce,	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Lussa (*Island of Mull*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Moidart,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Morar,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Mullanageren, Horasary, and Lochnaciste (*North Uist*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Nairn,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Naver and Borgie, *see* Halladale.		
Nell, Feochan, and Euchar,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ness,	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 1.
Nith,	From Sept. 10 to Feb. 24.	From Nov. 15 to Feb. 24.
Orkney Islands (*River from Loch of Stenness, &c.*),	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Ormsary (*Loch Killisport*), Loch Head, and Stornoway (*Mull of Cantire*),	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Pennygowan or Glenforsa, and Aros,	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.

Name of River.	Annual Close Time for Net-fishing.	Annual Close Time for Rod-fishing.
Resort, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ruel, ...	From Sept. 1 to Feb. 15.	From Nov. 1 to Feb. 15.
Sanda, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Scaddle, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Shetland Islands (*River of Sandwater, &c.*), . .	From Sept. 10 to Feb. 24.	From Nov. 16 to Jan. 31.
Shiel (*Loch Shiel*), . .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Sligachan, Broadford, and Portree (*Isle of Skye*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Snizort, Orley, Oze, and Drynoch (*Isle of Skye*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Spey, ...	From Aug. 27 to Feb. 10.	From Oct. 16 to Feb. 10.
Stinchar, ...	From Sept. 10 to Feb. 24.	From Nov. 15 to Feb. 24.
Tay (except Earn), . .	From Aug. 21 to Feb. 4.	From Oct. 16 to Jan. 14.
Thurso, ...	From Aug. 27 to Feb. 10.	From Oct. 6 to Jan. 10.
Torridon, Balgay, and Shieldag, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Tweed, ...	From Sept. 15 to Feb. 14.	From Dec. 1 to Jan. 31.
Ugie, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.
Ullapool (*Loch Broom*), .	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Urr, ...	From Sept. 10 to Feb. 24.	From Nov. 30 to Feb. 24.
Wick, ...	From Aug. 27 to Feb. 10.	From Nov. 1 to Feb. 10.
Ythan, ...	From Sept. 10 to Feb. 24.	From Nov. 1 to Feb. 24.

APPENDIX VII.

LIST OF CHAIRMEN AND CLERKS OF SALMON FISHERY DISTRICT BOARDS IN SCOTLAND.

District.	Name and Address of Chairman.	Name and Address of Clerk.
Alness, - -	Col. Alex. J. C. Warrand, Ryefield House, Conon Bridge, Dingwall.	William J. Duncan, Solicitor, Dingwall.
Annan, - -	A. Johnstone Douglas, Esq., Comlongan Castle, Ruthwell.	John F. Cormack, Solicitor, Lockerbie.
Awe, - -	The Duke of Argyll, Inveraray Castle, Inveraray.	Alex. MacArthur, Solicitor, Oban.
Ayr, - -	Richard A. Oswald, Esq., of Auchincruive, Ayr.	Wilfrid C. Macrorie, Commercial Bank, Ayr.
Balgay, - -	C. R. Manners, Esq., C.E., 12 Lombard Street, Inverness.	Duncan Shaw, W.S., 15 High Street, Inverness.
Bervie, - -	David Scott Porteous, Esq., of Lauriston, as mandatory of the Commissioners of Woods and Forests.	W. C. Walls, Solicitor, Montrose.
Bladenoch, -	The Mandatory of the Earl of Galloway.	John Black, Solicitor, Wigtown.
Broom, - -	W. Ewing-Gilmour, Esq., of Inverlael, per A. W. G. Aitken, Esq., S.S.C., Edinburgh.	W. R. T. Middleton, Solicitor, Dingwall.
Conon, - -	John Little Mounsey, Esq., W.S., 5 Thistle Street, Edinburgh, Commissioner for Col. J. A. F. H. Stewart Mackenzie of Seaforth.	W. R. T. Middleton, Solicitor, Dingwall.
Cree, - -	The Earl of Galloway, Cumloden, Newton-Stewart.	A. B. Matthews, Solicitor, Newton-Stewart.
Dee (Aberdeen),	The Lord Provost of Aberdeen.	Alex. Duffus, Advocate, Aberdeen.
Dee (Solway), -	Col. W. J. M. Baillie of Cally, Gatehouse.	W. Nicholson, Sheriff-Clerk, Kirkcudbright.
Deveron, - -	G. R. Sellar, Esq., Boddom, Peterhead.	James Morrison, Solicitor, Banff.
Don, - -	Vacant.	Alex. Duffus, Advocate, Aberdeen.
Doon, - -	Marquis of Ailsa, Culzean Castle, Maybole.	Wilfred C. Macrorie, Solicitor, Ayr.
Esk (North), -	The Rev. J. More Gordon of Charleton and Kinnaber, per H. More Gordon, Esq., Charleton, Montrose.	J. R. Findlay, Solicitor, Montrose.
Esk (South), -	William Douglas Johnston, Esq., Montrose.	D. S. Campbell, Solicitor, Montrose.
Findhorn, -	R. C. Munro Ferguson, Esq., of Novar, M.P., per J. J. Meiklejohn, Esq., factor.	William Grant, National Bank Buildings, Forres.
Forth, - -	Mandatory of Commissioners of Woods and Forests.	Patrick Welsh, County Buildings, Stirling.
Girvan, - -	John Campbell Kennedy, Esq., of Dunure.	T. Gerald Tait, Solicitor, Girvan.
Gruinard and Little Gruinard,	Alfred N. G. Aitken, Esq., S.S.C., Edinburgh, Factor and Commissioner for Hugh Mackenzie, Esq., of Dundonnell.	W. R. T. Middleton, Solicitor, Dingwall.
Kyle of Sutherland,	Sir Charles Lockhart Ross, Bart., of Balnagowan.	John M'Crone, Solicitor, Dornoch.
Little Broom, -	Alfred N. G. Aitken, Esq., S.S.C., Edinburgh, Factor and Commissioner for Hugh Mackenzie, Esq., of Dundonnell.	W. R. T. Middleton, Solicitor, Dingwall.

APPENDIX VII. (*continued*)—List of Chairmen and Clerks of Salmon Fishery District Boards in Scotland.

District.	Name and Address of Chairman.	Name and Address of Clerk.
Lochy, - -	Lord Abinger, Inverlochy Castle, Fort-William.	N. B. Mackenzie, Solicitor, Fort-William.
Lossie, - -	The Duke of Richmond and Gordon, Gordon Castle, Fochabers, per George Muirhead, Esq., Commissioner.	T. R. Mackenzie, Solicitor, Elgin.
Nairn, - -	Brodie of Brodie, Brodie Castle, Forres.	H. T. Donaldson, Solicitor, Nairn.
Ness, - -	Captain E. C. Ellice of Glengarry, Fort-Augustus.	Anderson & Shaw, Solicitors, Inverness.
Nith, - -	John Henderson, Esq., Solicitor, Dumfries.	C. Steuart Phyn, Procurator-Fiscal, Dumfries.
Sligachan, Broadford, & Portree (Skye)	Lachlan Macdonald, Esq., of Skeabost.	Kenneth Macrae, Sheriff-Clerk, Portree.
Snizort, Orley, Oze, and Drynock (Skye),	Lachlan Macdonald, Esq., of Skeabost.	Kenneth Macrae, Sheriff-Clerk, Portree.
Spey, - -	The Duke of Richmond and Gordon, Gordon Castle, Fochabers, per George Muirhead, Esq., Commissioner.	T. R. Mackenzie, Solicitor, Elgin.
Stinchar, - -	The Earl of Stair, Lochinch, Wigtownshire.	Stair M'Harrie, Rephad, Stranraer.
Tay, - -	Hon. Morton Stuart Gray, Kinfauns Castle, Perth.	Condie, Mackenzie, & Co., Solicitors, Perth.
Thurso, - -	Peter Keith, Esq., mandatory for Sir J. G. Tollemache Sinclair, Bart., of Ulbster.	David Keith-Murray, Solicitor, Thurso.
Torridon, -	C. R. Manners, Esq., C.E., 12 Lombard Street, Inverness.	Duncan Shaw, W.S., 15 High Street, Inverness.
Ugie, - -	Lieut.-Col. Ferguson, of Pitfour, Mintlaw.	Robert Gray, Solicitor, Peterhead.
Ythan, - -	Earl of Errol, Slains Castle, Aberdeenshire.	D. M. A. Chalmers, Advocate, Aberdeen.
Tweed (Police Committee of the Commissioners),	Sir Richard John Waldie-Griffith, Bart., of Hendersyde Park, Kelso.	David W. B. Tait, W.S., Kelso.

Note.—In addition to the districts specified above, the Duke of Sutherland is sole proprietor of the districts of the following rivers, viz. :—Helmsdale, Brora, Fleet, Kirkaig, Inver, Laxford, and Inchard (under the charge of his factor, Mr. Donald M'Lean, Dunrobin Office, Golspie) ; and the Halladale, Naver, Borgie, and Kinloch (under the charge of his factor, Mr. John Morrison, Tongue); W. E. Gilmour, Esq., of Rosehall, etc , is proprietor of the rivers Dionard, Polla, Strathy, and Armadale, also in the north of Sutherland, and part owner, with the Duke of Sutherland, of the river Hope ; Lord Lovat has practically sole right of fishing in the river Beauly (Mr. J. T. Garrioch, Beauly, factor); and the Countess of Cromartie is sole proprietrix of the district of the river Kinnaird (under the charge of her factor, Mr. George Wetherspoon, Cromartie Estate Office, Kildary).

Fishery Board for Scotland,
Edinburgh, April 1909.

APPENDIX VIII.

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TWENTY-SEVENTH ANNUAL REPORT.

TO THE RIGHT HONOURABLE

LORD PENTLAND,

His Majesty's Secretary for Scotland.

Office of The Fishery Board
for Scotland,
Edinburgh, *7th April*, 1910.

Your Lordship,

In continuation of our Twenty-seventh Annual Report we have the honour to submit—

PART III.—SCIENTIFIC INVESTIGATIONS.

GENERAL STATEMENT.

This part of the Twenty-seventh Annual Report deals with the scientific investigations which have been conducted by the Board in 1908 in connection with the sea fisheries of Scotland, so far as they have been completed, by means of the Parliamentary Vote granted for the purpose.

The scientific work has, as usual, been carried out under the supervision of Dr. T. Wemyss Fulton, the Scientific Superintendent under the Board, the researches having been undertaken chiefly at the Board's Marine Laboratory, Bay of Nigg, Aberdeen, and partly in the Clyde, in connection more particularly with the herring fishery there. The hatchery for sea fishes is also situated at the Bay of Nigg, Aberdeen, and a statement of the work done at it during the year will be found below.

As was explained in previous Reports, the investigations into the condition of the fishing-grounds in the Moray Firth and Aberdeen Bay, which were conducted for a number of years by means of commercial steam trawlers engaged for the purpose, have not been continued, for reasons formerly stated; but the statistics of the catches of line fishermen within the Moray Firth are regularly collected, and a report dealing with them and with the investigations in the Firth generally is in course of preparation.

In the Firth of Clyde, and in particular in Loch Fyne, the investigation into the herring fishery which has been in progress during the last few years was continued, and observations on the temperature of the water and the relative abundance of plankton were made as frequently and regularly as circumstances allowed. This subject is dealt with more fully below.

Among the researches in progress, but not yet completed, may be mentioned the relation between the salmon fishery and the herring fishery in Loch Fyne, the destruction of immature herrings by sea birds and certain predaceous fishes, the development of decapod crustacea, and the food of the halibut.

THE HATCHING OF PLAICE.

During the spawning season of 1908 the hatching of the eggs of the plaice at the hatchery was continued as in previous years. The methods employed have been described fully in previous Reports, but it may be mentioned that the adult plaice are kept alive in a large tidal pond, the spawning pond, where they shed and fertilise their eggs in a natural way during the spawning season. The eggs are then collected from the water by a large net and transferred to the hatching apparatus, which are of the Dannevig type, where they are retained till they hatch, the larval fishes or fry being also kept in the apparatus till the time when the yolk is nearly absorbed, when they are transferred to the sea at selected places.

Success primarily depends on having a large stock of breeding fishes in order that as great a quantity of eggs as possible may be obtained. In former years, when commercial trawlers were employed to fish under scientific observation in the Moray Firth and Aberdeen Bay, ample numbers of adult plaice were secured to stock the pond; but in recent years, as explained in previous Reports, considerable difficulty has been experienced in getting sufficient supplies. By means of the research steamer "Goldseeker," a considerable number of plaice suitable for breeding purposes were brought from the Moray Firth to Aberdeen in the autumn of 1907, and in consequence of this the quantity of eggs made available in the following season was increased, though it was still insufficient to work the apparatus to their full capacity.

The estimated number of eggs removed from the spawning pond was 15,332,000, and the number of fry obtained from them was estimated to be about 12,296,000. The first eggs were found on 13th January, and the last on 14th May. The number collected in each month during the spawning season, and the percentages to the aggregate, are shown as follows:—

	Number of Eggs.	Percentage.
January, - - - -	146,000	0·95
February, - - -	3,766,000	24·6
March, - - - -	7,170,000	46·7
April, - - - -	3,420,000	22·3
May, - - - -	830,000	5·4

The number of dead eggs which were removed from the hatching apparatus was estimated at 3,056,000, or about 20 per cent. of the total number collected, which is lower than usual. During the season the specific gravity of the water remained fairly constant at from 27·2 to 27·4. The mean monthly temperature in the pond was 37·9° F. in January, 40·0° F. in February, 39·7° F. in March, 42·0° F. in April, and 44·2° F. in May; in the hatching apparatus the mean monthly temperatures were 40·0° F. in January, 42·0° F. in February, 40·6° F. in March, 42·8° F. in April, and 47·0° F. in May.

The first larvæ to be hatched out appeared on 7th February, and during the season the young fishes were liberated in the sea in eight lots, between the 19th February and the 28th May. With the exception of the first and the last lots, the fry were liberated off the northern part of the coast of Aberdeen, in the neighbourhood of Fraserburgh and Sandhaven, the fishermen of the district having petitioned that that should be done. It may be mentioned that reports have been received that unusually large numbers of small plaice have been taken on the coast of Aberdeen, which is generally attributed by the fishermen to the liberation of fry from the hatchery. While it is not an easy matter to ascertain whether this opinion is well founded, or whether the increase in the abundance of young plaice is due to a natural cause or causes, apart from the liberation of fry altogether, the results of the prolonged experiments in Loch Fyne tend to support the view taken by the fishermen, and to show that the quantity of young plaice in the neighbourhood may be materially increased by piscicultural operations. These experiments, which were fully described in the Report for 1907, were carried on for thirteen years, in the first six of which large numbers of fry were liberated in the waters of the loch, while in the last six years no fry were added; and it was shown by periodic and systematic observations on the beach, that the young plaice which live there were found in rather more than twice the abundance in the years when fry were liberated than in the years when no fry were set free.

The number of the eggs of the plaice collected from the spawning pond, and the number of fry hatched out and liberated in the sea, in the various years since the hatchery was established at the Bay of Nigg, are as follows :—

Year.	Eggs Collected.	Fry Liberated.
1900 . . .	43,290,000	31,305,000
1901 . . .	65,377,000	51,800,000
1902 . . .	72,410,000	55,700,000
1903 . . .	65,940,000	53,600,000
1904 . . .	39,600,000	34,780,000
1905 . . .	40,110,000	24,500,000
1906 . . .	7,486,000	4,406,000
1907 . . .	1,627,000	1,282,000
1908 . . .	15,332,000	12,296,000
	351,172,000	269,669,000

The cost of the fish-hatching work as carried on at the Bay of Nigg, in conjunction with the laboratory, is very small, amounting to an estimated sum per annum of about £80, which represents extra expenditure for coals, oils, &c., and for occasional assistance to the attendant.

THE FISHERY STATISTICS.

Since the establishment of the Fishery Board in 1882, the Annual Reports have contained a large and important series of statistical tables relating to the sea fisheries of Scotland, and in a paper in this part of the present Report, those which refer to the quantities and values of the fish and shell-fish landed have been collated and discussed, and certain conclusions have been drawn from them as to the increase or decrease of particular kinds of fish in quantity or value, or in relation to the methods of capture. The statistics referring to the shell-fish go back to the year 1883, while from 1889 the quantity and value of most of the fishes landed have been detailed for each coast separately, and since 1892 the quantity and value of those taken by the three chief methods of capture—line fishing, trawling, and net fishing. The main lessons to be drawn from a study of the statistics over the period are that very satisfactory progress has been made in exploiting the sea fisheries as a whole; that a marked change has taken place as to the relative position of line-fishing and trawling with regard to the supply of demersal or bottom fishes; and that in the later years the great net fishery for herrings has been very considerably developed.

The aggregate quantity of fish landed, of all kinds and by all methods of fishing, on the coasts of Scotland in the 21 years, 1888–1908, amounted to 134,561,000 cwts., or an average of 6,407,670 cwts. per annum. In the first ten years, 1888–1897, the total quantity was 56,609,000 cwts., showing an annual average of 5,661,000 cwts., whereas in the last ten years the total quantity amounted to 71,394,000 cwts., the annual average being 7,139,000 cwts. There was thus an increase in the quantity of fish landed of 26 per cent. The increase among demersal fishes—that is, those which live at or near the bottom, as cod, haddock, flat-fishes, skates, &c.—in the period from 1892, amounted to about 20 per cent.; while the increase among pelagic fishes, which in Scotland means practically the herring alone, since 1892 amounted to about 31 per cent.

The variation on the different coasts was noteworthy. On the East Coast, in the latter half of the period 1889–1908, there was an increase in the total quantity of fishes landed amounting to about 11 per cent.; whereas on the West Coast there was a decrease amounting to nearly 17 per cent, while at Orkney and Shetland there was an increase of about 139 per cent., due to the great development of the herring fishing at Shetland. On the East Coast, in the latter half of the period 1892–1908 (during which the methods of fishing were distinguished), the increase in the quantity of pelagic fish landed amounted to about 6 per cent., while the increase at Orkney and Shetland was 186 per cent. On the other hand, there was a decrease on the West Coast amounting to about 7 per cent. Among the demersal fishes there occurred an increase of about 47 per cent. on the East Coast, and a decrease of about 35 per cent. on the West Coast. On all coasts a decrease in the quantity of fish taken by line was marked; on the East Coast it amounted to nearly 49 per cent., on the West Coast to about 40 per cent., and at Orkney and Shetland to 53 per cent. In contrast to this was the increase in the quantity of fish landed by trawlers, which is the most outstanding feature in connection with the East Coast fisheries in the period covered by the statistics. On that coast the increase amounted to 193 per cent.; on the West Coast, where, however, trawling is of very much less importance, the increase was about 163 per cent.

The aggregate value of the shell-fish landed in Scotland in the period from 1883 to 1908 was £1,957,880, or an annual average of £75,300; when the first half of the period is compared with the second, an increase in the latter is shown amounting to about 2·8 per cent. On the East Coast there was a decrease of nearly 19 per cent. in the value, while on the West Coast there was an increase of about 23 per cent., and at Orkney and Shetland an increase of about 26 per cent. With regard to oysters, there was an increase of about 50 per cent. in quantity and 26 per cent. in value, entirely due to the artificial cultivation of this shell-fish at certain places on the West Coast, and in particular in Loch Ryan. On the East Coast and at Orkney and Shetland there was a large decrease both in numbers and in value. The decrease in mussels amounted for Scotland to 37 per cent. in quantity and 43 per cent. in value; it was common to all coasts, but most marked on the East Coast, and it is to be attributed chiefly to the decline in line-fishing. Among lobsters there was an increase of 3·1 per cent. in numbers and 15·6 per cent. in value, due to increases on the West Coast and at Orkney; while among crabs there was a minute decrease in numbers and a slight increase in value. The percentages of the quantities landed on each coast in the two periods are shown as follows:—

	East Coast.		West Coast.		Orkney & Shetland.	
	1883-1895	1896-1908	1883-1895	1896-1908	1883-1895	1896-1908
Oysters	20·7	2·7	78·1	97·1	1·1	0·1
Mussels	69·1	63·4	29·1	34·7	1·6	1·7
Lobsters	15·2	14·3	72·0	70·6	12·7	15·1
Crabs	95·0	94·1	4·5	5·1	0·5	0·8

Appended to the paper are numerous Tables giving details as to the quantities and values of the various fishes and shell-fishes landed in each year throughout the period, with similar information regarding the shell-fish landed on the English coasts.

INVESTIGATIONS ON THE HERRING FISHERY OF THE FIRTH OF CLYDE.

Since the latter part of 1904 investigations have been carried on with reference to the herring fishery in the Clyde, and especially in Loch Fyne, as far as means allowed. It is to be regretted that the failure of the herrings to come into Loch Fyne in recent years in what may be termed their normal abundance still continues. The figures showing the result of the fishing in Loch Fyne since 1900 are as follows:—

Year.	Herrings Caught.	Year.	Herrings Caught.
1900, - -	24,743 crans.	1905, - -	4,672 crans.
1901, - -	29,117 „	1906, - -	5,258 „
1902, - -	26,339 „	1907, - -	3,914 „
1903, - -	21,198 „	1908, - -	4,070 „
1904, - -	7,827 „		

The statistics for the Loch Fyne fishery go back to the year 1854, and only in one year in that period was the quantity of herrings taken less than it was in 1907, namely, in 1873, when 3,648 crans were landed. At that period there was a similar depression, but it did not last so long, there being only three years—1872–1874—when the quantity was less than 10,000 crans, as compared with the six years, as shown above, in the present period. In 1908 there were indications that herrings were fairly plentiful in the lower reaches of the loch, but they invariably remained in deep water, where they could not be caught, but in the last week of June there was a movement which resulted in a large catch.

As mentioned in former reports, periodic observations on the abundance of the plankton, or minute floating life in the sea, upon which the herrings principally subsist, and upon the temperature of the water, have been made in Loch Fyne, and these observations are being continued. A preliminary report, by Dr. Thomas Scott, on the distribution of the pelagic crustacea in Loch Fyne will be found in the present Report, the tow-net collections made in the years 1905–1908, some 600 in number, being dealt with. The variations at the six stations where the collections were made are shown in each of the years, and the organisms present are described. It is proposed to carry on these investigations and observations in the loch until the herrings have returned to it in something like their former abundance. Since they were begun at the end of 1904, after the decline in the herring fishery had set in, it is obviously necessary to continue them until the herring shoals return again, and until a sufficient body of information has been obtained to make it possible to decide whether any special change in the physical conditions of the waters of the loch, or in the abundance of the organisms upon which the herrings feed, was characteristic of the period of depression in the herring fishery.

The Herrings of the Clyde and other Districts.

Since 1905 samples of the herrings taken in the Clyde and at some other parts of the coast have been sent to the marine laboratory, with the view more particularly of determining certain points in their reproduction and spawning, and a paper on the subject, by Dr. H. C. Williamson, is contained in this Report. Over 156 samples of herrings were examined during the years in question, their length and, in most cases, their weights determined, as well as the state of development of the reproductive organ and the size of the eggs contained in the ovaries. The particulars are set forth in copious lists, the immature herrings being distinguished from the spawners and the spent, and as far as possible the summer-spawners from the winter-spawners, and it is thus possible to arrange for each locality and over a period the main characters connected with the reproduction of the shoals. It has been shown that about six months elapse between the formation of yolk in the ovarian eggs and the period of spawning, but it has not yet been determined how long a time may elapse after a herring arrives at the "full" condition, that is, with a large roe or milt, as is found in the large herrings in the upper part of Loch Fyne towards the end of the year, and the actual shedding of the eggs. The rate of growth of the herring and the spawning-seasons are discussed. Each locality has very definite spawning-seasons, a fact pointing to the fishes themselves being localised and dependent on the local conditions of food, temperature, and salinity; but taking these samples from various parts of the coast as a whole, spawning may be regarded as starting in July and continuing to the following July, with two great periods, in August and September and in February and March.

THE INFLUENCE OF TEMPERATURE ON THE DEVELOPMENT OF THE EGGS OF THE HERRING.

At the request of the Government of New Zealand, a series of experiments were made at the Marine Laboratory on the retardation of the development of the ova of the herring. Information was desired as to whether it was possible to prolong the period of incubation 50 days, an interval which would admit of the eggs being conveyed from this country to New Zealand before they hatched. The New Zealand Government wish to introduce, if possible, certain of the more valuable and useful of the European fishes to the waters of the Dominion, and among them the herring. The experiments referred to are described in the present Report by Dr. H. C. Williamson, the eggs being obtained at Anstruther in the spring, and they were kept in various forms of apparatus, and at various temperatures, until hatching took place. The general result of the experiments was to show that it would be possible to keep a proportion of the eggs for a period of fifty days before hatching—a few were indeed kept some days longer, but by far the greater number succumbed at an earlier period. The experiments may be regarded as of a preliminary kind, and from the experience gained it is hoped that in the further trials now being made at the request of the New Zealand Government, a much larger proportion may survive the prolonged exposure to low temperatures. Experiments were also made, at the request of the New Zealand authorities, with the eggs of the haddock and of the plaice, as well as with small turbots, with the view of determining whether the period of development of the former could be satisfactorily delayed, and whether the latter were able to resist low temperatures. The temperatures in the experiments with the eggs varied from 0·6° C. to 5·6° C., and it was found that the plaice eggs hatched after a period of from 27 to 43 days, while the haddock eggs were partly unhatched after the lapse of 30 days. The small turbot, measuring 6¼ and 9½ inches, were placed in separate apparatus. One of them, subjected to temperatures going down to 0·6° C., survived for over three days and then died; the other, subjected to temperatures between 3·4° C. and 1·7° C. for over two days, survived and recovered.

SCIENTIFIC AND TECHNICAL INSTRUCTION TO FISHERMEN.

For a number of years past, as mentioned in previous Reports, representative fishermen selected by the County Councils of various counties have visited the Marine Laboratory and Hatchery for the purpose of receiving some instruction relating to the life-histories and habits of the marine food fishes, such as might be of interest and use to them, and to see the processes of fish-hatching. Advantage was taken of these demonstrations last spring by delegated fishermen from the counties of Elgin, Sutherland, Inverness, Argyll, Berwick, Fife, Kincardine, and Caithness, who attended with regularity and appeared to be much interested in the instruction they received.

We have the honour to be,

Your Lordship's most obedient Servants,

ANGUS SUTHERLAND, *Chairman.*
D. CRAWFORD, *Deputy-Chairman.*
D'ARCY W. THOMPSON.
W. R. DUGUID.
L. MILLOY.
D. MEARNS.
H. WATSON.

DAVID T. JONES, *Secretary.*

SCIENTIFIC REPORTS.

I.—ON THE HERRINGS OF THE CLYDE AND OTHER DISTRICTS.

By H. CHAS. WILLIAMSON, M.A., D.Sc., F.R.S.E., Marine Laboratory, Aberdeen.

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In 1905 Dr. Fulton arranged for samples of herrings from the Clyde and other districts to be sent to the Laboratory. They were obtained from commercial fishing vessels. The herrings were in most cases sprinkled with salt, and sent by rail to Aberdeen. On arrival they were in some instances examined immediately; in other cases they were kept in the cold store until required. The fishery officers in the different districts forwarded most of the samples. A large and valuable series of samples was sent by Mr. Johnston and the other officers in the Clyde district.

The scheme of enquiry drawn up by Dr. Fulton included records of the length and weight of the fish, the sex, weight of the reproductive organs, the sizes of the eggs, and general notes regarding the food, fat, &c.

In the following pages I give an analysis of all the samples, and also of certain other lots of herrings which were preserved at the Laboratory. Together they make a total of 147 samples. The herrings are classified under the following headings:—(*a*) Immature, *i.e.*, herrings that have never spawned; (*b*) Spawners, *i.e.*, those herrings in which the reproductive organs have begun to ripen. They may be recognised several months before they will spawn by the fact that the eggs have begun to show yolk in them. They are sub-divided into winter and summer spawners. (*c*) Spent herrings. They were further separated into winter and summer spents. The spent is readily recognised immediately after it has spawned, but it becomes more and more difficult to diagnose, as the reproductive organs eventually assume a small, shrunken appearance, which may be confounded with an immature.

I have taken as a basis the generally-accepted division of herrings into summer and winter spawning groups. As has been pointed out by several writers, the spawning season for each group is an extended one. It would probably be right to make two extra spawning seasons, viz., spring and autumn. While it seems probable that considerable quantities of herrings spawn in the autumn season, it may be that it is really a season of late summer spawners and early winter spawners. During every month of the year some of the herrings in the samples were full herrings, *i.e.*, the condition where the reproductive organ is so large that it can be detected on the outside of the fish, owing to its filling up the abdomen and offering resistance to compression with the fingers. In some cases, *e.g.*, Upper Loch Fyne, July, the full herrings have been males chiefly, and they might simply be regarded as complying with a fairly well established fact that the males are ripe before the females. But there are full females occurring then also, and, considering the small number of herrings examined, the fact of their appearance at all in the samples indicates that they must be present in each month in fairly large numbers.

Arrangement of Analysis.

The form in which the analysis will be arranged is as follows. The herrings are grouped under three districts:—(1) the Clyde, (2) the West Coast, (3) the East Coast. A list of the samples from each district is given for each month of the year. The date of each is stated, but lots belonging to different years are grouped together. In the majority of samples the herrings are mixed. Very often summer spawners are found with winter spawners, immature herrings with herrings that are nearly ripe, spent herrings with others that are preparing to spawn. Each sample then is divided up into the different classes represented, the number of individuals belonging to each being mentioned. In order to avoid the repetition of the full names, winter spawners, summer spawners, &c., the following contractions are used:—"S." and "W." stand for summer and winter respectively, while "Spg." and "Aut." represent spring and autumn; "Spr." signifies spawner, while "Spt." stands for spent. These two contractions may be combined with any of the letters denoting the season of the year, thus:—"W. Spr" means winter spawner, while "S. Spt." denotes summer spent. The term spawner ("Spr.") is applied to a herring as soon as the reproductive organs begin to ripen, *i.e.*, about six months before it spawns, and is continued until the herring becomes a "full" ("F.") herring. Immature herrings are represented by "Imm." Immature herrings which show that they have started to ripen, *i.e.*, in order to spawn for the first time, are denoted by "Imm. dev." (immature developing).

The range of length of the herrings is given in centimetres ("cm."). The extreme length is given, viz., from the point of the lower jaw to the end of the longest caudal fin-rays. The range in size of the diameter of the eggs in the ovaries is then added in millimetres ("mm.") The breadths of the ovary ("o") and testis ("t") are given in millimetres. All the ovaries and testes of the herrings have not, however, been measured, so that the data are not to be regarded as exclusive.

An important character in the herring is the amount of abdominal fat present. This varies very much. Even in the one class of herrings it is seldom that all the herrings exhibit the same amount of abdominal fat. Very often two quantities are stated, which give an idea of the limits or average condition among each lot.

Where the condition of the stomach was examined the presence or absence of food is noted. The quality of the food of a large number of the herrings here dealt with is treated by Dr. Scott.

List of Contractions.

Aut.—Autumn.
dev.—Developing.
F.—Full.
Fat—Abdominal Fat.
Imm.—Immature.
Imm. dev.—Immature developing.
o—Ovary.

S.—Summer.
Spg.—Spring.
Spr.—Spawner.
Spt.—Spent.
t—testis.
W.—Winter.

At the end of each month the herrings are slumped, and the characters of each class are then shown in general and discussed. A table gives the weights in *grammes* of all the herrings at each centimetre size, the weights in *grammes* of the pair of reproductive organs (ovaries or testes), the breadth of the reproductive organs in mm., and the diameter of the eggs in mm. All the herrings examined in the month are not included, because these data were not noted on every herring.

The herrings of each class have been arranged together for each month, and have been grouped in the tables given on pp. 59 to 62.

THE SAMPLES OF HERRINGS.

JANUARY.

CLYDE.—Campbeltown, Macrinnan's Pt., 18th January 1906:—16 W. Spr. F., 23 to 31 cm.: eggs, 1·1–1·3 mm.: o, 25–35 mm.; t, 20–30 mm. These herrings had their stomachs full of schizopods.

CLYDE.—Campbeltown, Mouth of Harbour, 20th January 1909:—9 Imm., 19 to 23 cm.: eggs, ·12, ·15 mm.: o, 3–4 mm.: t, 1·5, 3 mm.: fat, large quantity; 20 Imm. dev , 18 to 24 cm. : eggs, ·2, ·3 mm.: o, 3–5 mm. : t, 3–4·5 mm. : fat, large quantity; 15 W. Spr., 19 to 25 cm. : eggs, ·4–·8 mm.: o, 7–15 mm.: t, 10–20 mm.: fat, a little, a large quantity; 2 S. Spr. ♀, 21, 25 cm.: eggs, ·15, ·35 mm. : o, 3, 4 mm.: fat, large quantity; 1 S. Spt. ♂, 25 cm. : t, 4 mm.

CLYDE.—Campbeltown, Kildalloig Bay, 22nd January 1907:—15 W. Spr. F., 26 to 32 cm. : eggs, 1·1, 1·2 mm. ; o, 22–32 mm. : t, 26–35 mm. : fat, none. They all, with two exceptions, had food in their stomachs. Two stomachs were empty; the majority of the remainder were distended with copepods. This sample includes some herrings three years old.

CLYDE.—Campbeltown, Kildalloig Bay, 24th January 1907:—55 W. Spr. F., 23 to 31 cm. : eggs, 1·0–1·3 mm.: o, 20–34 mm.: t, 20–43 mm.; fat, none or merely a trace. Most of these herrings had remains of food in their stomachs. Some stomachs were filled with copepods, while others were empty.

CLYDE.—Off Largs, 16th January 1907:—50 W. Spr. 23, to 28 cm.: eggs, ·4–1·2 mm.: o, 6–23 mm. : t, 12–29 mm. : fat, much, none; 1 S. Spt. ♂, 24 cm.: t, 8 mm., shrunken: fat, none: this is possibly an autumn spent. In most cases there were remains of food (schizopods) in the stomachs; some stomachs were empty.

CLYDE.—Gareloch, 22nd January 1907:—2 Imm. dev., 20, 23 cm.: eggs, ·25 mm.: o, 3·5 mm. : t, 3 mm. : fat, large quantity; 40 W. Spr., 20 to 26 cm. : eggs, ·6–1·1 mm. : o, 8–24 mm. : t, 7–25 mm. : fat, very little, large quantity. Stomachs empty.

CLYDE.—Loch Fyne, Ardrishaig, January 1906:—6 W. Spr., 25 to 32 cm.: eggs, ·9–1·3 mm.

WEST COAST.—Stornoway, 2–3 miles off Tolsta Sands, 15th January 1907:—37 W. Spr., 27 to 30 cm. : eggs, ·8–1·2 mm.: o, 10–30 mm. : t, 20–34 mm.: fat, none or only a trace. Some stomachs contained the remains of food (crustacea); others were empty.

WEST COAST.—Loch Broom, 26th January 1905:—12 Imm., 19 to 25 mm.: eggs, not yolked: o, small; t, small, pink in colour; 13 S. Spr., 20 to 25 cm.: eggs, up to ·35 mm, getting yolked: o, small, developing: t, small, white ripening; 18 W. Spr., 22 to 30 cm.: eggs, ·5–1·2 mm.; 5 Spt., 26 to 29 cm.: eggs, ·2, ·25 mm., not yolked.

EAST COAST.—Firth of Forth, 3rd January 1908:—112 Imm. and Imm. dev., 11 to 22 cm.: eggs, ·1–·2 mm.: o, 1·25–4 mm.: t, 1–4 mm.: fat, large quantity, a little. The herrings from 15 cm. upwards show eggs ·17 and ·2 mm. : they will probably spawn during the summer ; 8 W. Spr., 19 to 25 cm. : eggs, ·6–·9 mm. : o, 9–12 mm. : t, 15–23 mm. : fat, a little, large quantity. All the stomachs were empty.

Summary of Each Class Represented.

IMMATURE, 11 to 25 cm.: eggs, ·1–·15 mm.: o, 1·25–4 mm.: t, 1–4 mm.: fat, a large quantity, a little.

IMM. DEV., 15 to 24 cm.: eggs, ·17–·3 mm.: o, 2·2–5 mm.: t, 2–4·5 mm.: fat, large quantity.

W. SPR., 19 to 32 cm. : eggs, ·4–1·3 mm. : o, 6–35 mm. : t, 7–43 mm. : fat, none, large quantity.

S. SPR., 20 to 25 cm. : eggs, ·15, ·35 mm. : o, 3, 4 mm.: fat, large quantity.

The *immature* condition in the ovary consists in its clear translucent structure, closely packed septa, solid with eggs. When the eggs are very small they are of an uniform size, whereas the spent roe seems to have a bigger range in size. The immature fishes generally have a large quantity of fat, and that may always give the abdomen a full appearance.

The *immature* testis, 40 mm. long and 3 mm. broad, has a clear glistening outer surface. It has some longitudinal wrinkles on its flattened side. It has a solid spongy structure. If teazed and washed in water, a quantity of white coagulable matter is washed out, leaving a shreddy condition, but no definite honeycomb structure. When the testis begins to ripen (*e.g.*, 48 mm. × 4 mm.) the testis may be very soft and pasty in texture. A large quantity of albuminous matter can be washed out, leaving a distinct honeycomb. On teazing an immature testis with needles it tends to split longitudinally.

The *Winter Spawners* had eggs ·4–1·3 mm., while the immature developing and summer spawners had eggs ·15–·3 mm. If we add these two lots together we get a complete series from the immature condition right on to the ripe. This would seem to indicate a continuous spawning from January to summer.

The testis of a *Summer Spent* 25 cm. in length measured 71 mm. in length by 4 mm. broad. It was pale and opaquish. It was wrinkled longitudinally. When a transverse section was cut it proved to be very extensile. There was not much albuminous matter washed out, but a honeycomb structure was found. The vas deferens and the blood vessel were large.

In the following table the *range of weight* of the herrings, the weight of the reproductive organs and the breadth of the same, and the size of the eggs in the ovary are given for each size of the fish. The extremes of the ranges are alone given in the case of the total weight and breadth of the reproductive organs. Only where there are more than two values are the extremes united by a dash.

In the case of the diameter of the eggs, where two sizes are united by a dash it signifies that eggs occurred at every ·1mm. Thus where the range (*e.g.*, for 22 cm.) is given as ·12–·7, eggs were found, in separate fishes, at ·12, ·2, ·3, ·4, ·5, ·6, ·7 mm.

The weight of the reproductive organs means the weight of the pair of testes, or ovaries.

Length.	Range of Weight.	Weight of Reproductive Organs.*	Breadth of Reproductive Organs.†	Diameter of Eggs.†
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
11	..	..	1.2	·1
12	..	..	1·5	·1
13	..	..	2	·1
14	..	..	1·5	..
15	..	..	1–2·5	·12, ·2
16	..	..	1–2·2	..
17	..	..	1·5–4	·15, ·17
18	..	..	1·5–3·5	·15–·3
19	..	..	1·5–15	·12–·2
20	61, 64	·5, ·8	2·5–9	·15–·25, ·7
21	68–79	2–5	2–17	·12–·35, ·5–·9
22	75–99	4–8	3–18	·12–·7, ·9
23	80–114	·2–13	3–28	·15, ·35–·8, 1·0–1·2
24	75–125	1·3–21	4–24	·17–·4, ·6, ·7, ·9–1·1
25	95–150	3·4–21	·4–25	·6–1·2
26	108–161	1·2–38	10–32	·2, ·25, ·5–1·3
27	131–191	·8–46	18–30	·1–·25, ·9–1·3
28	154–243	12–47	17–30	·9–1·2
29	166–238	1·4–48	20–34	·25, 1·0–1·2
30	181–285	6·5–60	10–38	·8–1·2
31	193–321	35–66	25–43	1·0–1·2
32	265–319	55, 59	28	1·3

* Herrings from Clyde and West Coast.
† Herrings from Clyde, West Coast, and East Coast.

FEBRUARY.

CLYDE.—Campbeltown, Ardnacross Bay, 5th February 1907 :—1 Imm dev. ♀, 26 cm.: eggs, ·25 mm.: o, 4 mm.: fat, some ; 57 W. Spr. F., 22 to 31 cm.: eggs, 1·0–1·25 mm.: o, 16–30 mm.: t, 17–38 mm.: fat, none, a little. All had, with one or two exceptions, big stomachs full of copepods, etc.

CLYDE.—Campbeltown, Davaar Island, 14th February 1905 :—12 W. Spr. F., 29 to 32 cm.

CLYDE.—Campbeltown, Kildalloig Bay, 22nd February 1907 :—4 Imm., 22, 23 cm. ; 23 W. Spr. F., 22 to 30 cm.: eggs, 1·0, 1·1 mm.: o, 14–28 mm.: t, 10–24 mm.: fat, none; 16 W. Spt., 22 to 31 cm.: fat, none. There were remains of food in the stomachs of both fulls and spents.

CLYDE.—Ballantrae Bank, 28th February 1907 :—41 W. Spr. F., 23 to 27 cm.: eggs, 1·1–1·35 mm.: o, 17–28 mm.: t, 20–30 mm.: fat, none. Their stomachs were empty; in one fish there was a brown fluid in the gut.

CLYDE.—Loch Striven, 20th February 1907 :—169 Imm., 14 to 23 cm.: eggs, ·1, ·15 mm.: o, 2–4 mm.: t, 2, 3 mm.: fat, large quantity, some; 18 Imm. dev., 17 to 21 cm.: eggs, ·25–·4 mm.: o, 3–5 mm.: t, 4 mm.: fat, large quantity; 22 Spg. Spr., 17 to 21 cm.: eggs, ·4–·6 mm.: o, 5–8 mm.: t, 4–8 mm.: fat, large quantity, none; 31 W. Spr., 18 to 21 cm.: eggs, ·7–1·1 mm.: o, 9–16 mm.: t, 7–19 mm: fat, none, some. The stomachs were empty.

WEST COAST.—Stornoway, off Cellar Head, 5th February 1908 :—27 W. Spr. F., 27 to 31 cm. Food was found in one fish; the stomachs of the others were empty.

West Coast.—Stornoway, 2–3 miles off Tolsta Sands, 12th February 1907:—35 W. Spr., 24 to 32 cm.: eggs, ·8–1·1 mm.: o, 15–27 mm.: t, 20–32 mm.: fat, none, some. Schizopods and a sand-eel were observed in certain stomachs; the majority of the latter were empty.

West Coast.—Stornoway, 14 miles N.-W. of Butt of Lewis, 23rd February 1899:—7 W. Spr. F., 29–34·5 cm.

West Coast.—Loch Broom, 17th February 1905:—4 Imm. dev., 21 to 24 cm.; 2 Spg. Spr. ♂, 23 cm.; 4 W. Spr. F., 25 to 27 cm.

East Coast.—Firth of Forth, 18th February 1909:—4 Imm., 21, 22 cm.: o, very small: t, very small: fat, large quantity; 24 W. Spr., 21 to 27 cm.: eggs, ·9–1·1 mm.; 1 W. Spt. ♀, 21 cm. A little food was observed in certain of the stomachs.

East Coast.—Vicinity of St. Andrews Bay, 11th February 1903:—4 Imm., 14 to 19 cm.: fat, large quantity, none; 12 W. Spr. F., 23 to 28 cm.

East Coast.—Firth of Tay, 8th February 1905:—50 Imm., 7 to 19 cm.: eggs, ·07–·15 mm.: o, 1·5–3·5 mm.: t, ·7–3 mm.: fat, large quantity, none; 1 W. Spr. F. ♂, 17 cm.: t, 10 mm.: fat, some.

East Coast.—Firth of Tay, 26th February 1906:—379 Imm., 8 to 20 cm.: o, 2 mm.: fat, a little; 2 Imm. dev. 18, 19 cm.: o, 4 mm.; t, 5 mm.; 2 W. Spr. ♀, 21 cm.

East Coast.—Moray Firth, 8th February 1905:—2 Imm. 13, 14 cm.: fat, none; 4 Imm., 15 to 18 mm.: fat, large quantity; 11 Imm. dev., 17 to 22 cm.: fat, large quantity; 4 W. Spr. F., 21 to 26 cm.

Summary.

Immature, 8 to 23 cm.: eggs, ·07–·15 mm.: o, 1·5–4 mm.: t, ·7–3 mm.: fat, large quantity, none.

Imm. dev., 17 to 24, 26 cm.: eggs, ·25–·4 mm.: o, 3–5: t, 4 mm.: fat, large quantity, some.

Spg. Spr., 17 to 23 cm.: eggs, ·4–·6 mm.: o, 5–8 mm.: t, 4–8 mm.: fat, large quantity, none.

W. Spr., 17 to 34 cm.: eggs, ·7–1·35 mm.: o, 9–30 mm.: t, 7–38 mm.: fat, none, some.

Immature.—The immature ovary is plump, smooth on the outside except for the curved bossing, due to the growth of the eggs stretching the skin. The vein is wide. The eggs are, under the microscope, visible through the skin. The lower edge of the ovary is crenate, marking the internal transverse division by septa. In section the ovary is triangular or wedge-shaped. The section is filled with eggs, which are closely packed in the septa. There is no spacing between the eggs, which in one fish 17 cm. long were ·1 mm. in diameter. Some eggs were larger; they were oval, measuring in long diameter ·15 mm. The eggs have very large nuclei. Some very small eggs—viz., ·03 mm. in diameter—were also noticed. In a spent ovary there is usually spacing between the eggs when the majority are as small as the above.

The immature testis, in herrings 14–16 cm. long, has a smooth, unwrinkled external skin; the vas deferens and the vein are large. The testis is a solid filled with small cells. On teazing a portion in water very little of the white coagulable matter was washed out. No honeycomb structure was made out. The testis is a little crenate along its free edge.

Winter Spawners.—They measured from 17 to 34 cm. in length; 17 cm. or less is then the lower limit of the first spawning shoal of winter spawners. When all the winter spawners, viz., winter spawning developing, table, p. 61, and "fulls," table, p. 60, are combined, there appears to be a break in the series at 27 cm., but I am not able to regard that size of any definite significance.

Some of the herrings from Ballantrae Bank were running.

A number of spents appeared in certain of the samples. Some of these were just spent, while others had spawned some time previously; this fact was indicated by the condition of the reproductive organs, which were shrunken a little and recovered to some extent.

If the herrings with developing reproductive organs be combined, we shall have a complete series of ovaries from the immature up to the ripe condition, and having ova from ·1 up to 1·3 mm. I assume that the herrings that are just starting to develop with eggs, say, ·25 mm. in diameter will spawn in summer. And as some of the herrings are spawning at present, it would seem to prove that spawning must take place continuously from winter to summer.

Comparatively large eggs are found in small ovaries of fishes 17 to 21 cm. in length. Eggs ·3 mm. in diameter were found in ovaries 3 and 4 mm. broad; eggs ·4 mm. in diameter, in ovaries 4–6 mm. broad; eggs ·5 mm. in diameter, in ovaries 5–7 mm. broad; eggs ·6 mm. in diameter, in ovaries 7 and 8 mm. broad; eggs ·8 mm. in diameter, in ovaries 9 and 10 mm. broad; eggs ·9 mm. and upwards in diameter, in ovaries 10–17 mm. broad.

Length.	Range of Weight*	Weight of Reproductive Organs.*	Breadth of Reproductive Organs. †	Diameter of Eggs. †
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
11	. .	. .	1	. .
12	. .	. .	1, 1·5	·07
13	. .	. .	1–2	·07, ·1
14	. .	. .	1–1·5	·1
15	22–26	. .	1·5–2·5	·1
16	23–30	. .	1·5–3	·1
17	31–35	. .	2–10	·15, ·3, ·4
18	31–52	·5–3	2–14	·1, ·3, ·4
19	39–52	·8–6	3–19	·15, ·2, ·4, ·5, ·7–1·1
20	47–60	2–5	3–17	·5, ·6, ·9, 1·0
21	62, 68	1·8–9	2–18	·6, ·8, 1·1
22	62–77	8, 10	16, 17	·9, 1·2
23	72–111	2–24	3–22	1·0–1·3
24	92–126	9–32	17–28	1·0–1·3
25	98–131	7–27	18–30	1·0, 1·1
26	110–153	·5–35	4–33	·25, 1·0–1·2
27	133–172	14–35	18–28	1·0–1·3
28	139–184	10–36	17–38	·9–1·2
29	153–203	10–39	15–30	·8–1·2
30	163–230	17–47	16–30	1·0–1·2
31	213–301	40–81	29, 33	. .
32	236	42	32	. .

* Herrings from Clyde and West Coast.

† Herrings from Clyde, West Coast, and East Coast.

March.

Clyde.—Campbeltown, off Isle of Ross, 4th March 1908:—54 W. Spt., 24 to 29 cm.

Clyde.—Campbeltown, Mouth of Loch, 11th March 1905:—2 W. Spr., F. ♂., 24, 26 cm.; 22 W. Spt., 21 to 27 cm.

Clyde.—Campbeltown, Kildalloig Bay, 24th March 1903 :—27 W. Spt., 21 to 29 cm.: eggs, ·1–·2 mm.

Clyde.—Campbeltown, Kildalloig Bay, 12th March 1907 :—1 Imm. ♂., 23 cm.: t, 3·5 mm.: fat, a little; 1 Imm. dev. ♀, 22 cm: eggs, ·35 mm.: o, 4 mm.: fat, a little; 47 W. Spt., 22 to 28 cm.: fat, none, much. Food was generally present, in some cases in large quantity, in the stomachs.

Clyde.—Machrie Bay, Arran, 24th March 1908 :—10 W. Spr. F., 21 to 23 cm.; 43 W. Spt., 21 to 28 cm.

Clyde.—Ballantrae Bank, 13th March 1907 :—42 W. Spr. F., 23 to 29 cm.: eggs, 1·1–1·25 mm.: o, 17–23 mm.: t, 22, 26 mm.: fat, none, a trace; 1 W. Spt. ♂., 27 cm. One full herring had food in its stomach. No food was found in the other herrings examined.

Clyde.—Kilbrennan Sound, Carradale, 26th March 1907 :—83 W. Spt, 21 to 28 cm.: eggs, ·12 and ·15 mm.: fat, none. In the majority of cases food (copepods and schizopods) was present. Some herrings had large stomachs filled with these forms.

Clyde.—Kilbrennan Sound, near Skipness Wharf, 27th March 1907 :—2 Imm. ♂., 22, 23 cm.: t, 2·5, 3 mm.: fat, some; 1 Imm. dev. ♀., eggs, ·3 mm.: o, 4 mm.: fat, none; 1 W. Spr. F. ♀., 21 cm.: fat, none; 111 W. Spt., 19 to 26 cm.: eggs, ·1–·2 mm.: o, 3–9 mm.: t, 3–10 mm.: fat, none, some; 4 S. Spr., 22 to 24 cm.: eggs, ·3–·45 mm.: o, 4–6 mm.: fat, much, none.

West Coast.—Stornoway, 12th March 1907 :—26 W. Spr. F., 26 to 31 cm.: eggs, 1·1–1·2 mm.: o, 20 mm.: fat, none; 26 W. Spt., 27 to 33 cm.: fat, none. Both full and spent herrings had big stomachs full of schizopods; in both classes some stomachs were empty.

West Coast.—Loch Broom, 16th March 1905 :—8 Imm., 18 to 22 cm.: eggs, ·15 mm.; 1 W. Spr. F. ♀., 25 cm.; 2 W. Spt., 22, 26 cm.; 14 S. Spr., 18 to 22 cm.: eggs, ·25–·35 mm.

East Coast.—Anstruther, 25th March 1905 :—31 W. Spr. F., 20 to 26 cm.

Summary.

Immature.—18 to 23 cm.: eggs, ·15 mm.: t, 2·5–3·5 mm.: fat, some.

Imm. dev.—22, 23 cm.: eggs, ·3, ·35 mm.: o, 4 mm.: fat, none.

W. Spr. F.—20 to 31 cm.: eggs, 1·1, 1·2 mm.: o, 17–23 mm.: t, 22, 26 mm.: fat, none, a trace.

W. Spt.—19 to 33 cm.: eggs, ·1–·2 mm.: o, 3–9 mm.: t, 3-10 mm.: fat, none, much.

S. Spr.—18 to 24 cm.: eggs, ·25–·45 mm.: o, 4–6 mm.: fat, much, none.

Winter Spawners.—In the hind part of the oviduct of the full herring the ripe eggs were concreted together, and the eggs had, through mutual pressure, assumed a spindle-shape. The germinal tissue between the ripe eggs in the ovary contains eggs measuring from ·05–·2 mm. in diameter. In the ripe testis the milt is in the form of a white pasty material. The skin of the testis is ridged in the form of a honeycomb on its internal surface; blood vessels run through it.

Winter Spents.—The spent fish is thin, slack in the abdomen, and very often has no abdominal fat. When recently spent the reproductive organ is very soft and flabby. In the ovary old eggs which had been ripe, but which had not been extruded, may be found loose; the other eggs present in the ovarian tissue are minute, about ·15–·2 mm. in diameter. The ovary soon shrinks to a small size. Some spent ovaries were as small as 3 and 3·5 mm. in breadth. They may shrink to a flattened condition.

The testis is very similar. Old sperm can be washed out of the testis, leaving an open honeycomb, sponge structure. Some of the testes had shrunk to a breadth of 2·5 and 3 mm.

Herrings from Clyde and West Coast.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of the Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
19	44	..	3	..
20	56	·1	2·5, 3	·17
21	54–67	..	2·5–7	·15
22	62–84	<1	2·5–7	·1–·4
23	71–99	<2–20	3–21	·1–·35, 1·2
24	81–110	1–18	3–22	·1–·3, 1·2
25	89–128	1·8–23	9–26	·12, ·15, 1·1
26	100–137	<1–14	8–17	·15, 1·2
27	103–163	11–28	11, 19	1·1, 1·2
28	111–176	16, 22	..	1·1, 1·2
29	143–189	..	..	..
30	171–191	..	..	..
..	..	..	..	..
33	194	..	..	..

APRIL.

CLYDE.—Campbeltown, off Macrinnan's Point, 3rd April 1906 :—1 W. Spr. ♀, 20 cm. : partly spawned ; 85 W. Spt., 21 to 28 cm. : eggs, ·05, ·1 mm. : o, 10, 15 mm. : t, 8–14 mm. : fat, none. There was food (copepods) in many stomachs ; some were empty.

CLYDE.—Campbeltown, off Macrinnan's Point, 21st April 1908 :—2 Imm. ♂, 22, 24 cm, : t, very small : fat, great quantity ; 77 W. Spt., 19 to 28 cm. : fat, none, some. The stomachs were empty.

CLYDE.—Campbeltown, off Isle of Ross, 8th April 1908 :—74 W. Spt., 22 to 28 cm. : fat, none. The stomachs were empty.

CLYDE.—Campbeltown, Machrie Bay, 9th April 1907 :—100 W. Spt., 0, 4–13 mm. : t, 3–13 mm. : fat, none. Traces of food were present in the stomachs.

CLYDE.—Kilbrennan Sound, 1 mile N. of Skipness, 10th April 1908 :—1 Imm. ♀, 20 cm. : o, small : fat, great quantity ; 110 W. Spt., 19 to 27 cm. : o, small : t, small : fat, none, some. Food was noticed in some cases ; it consisted of copepods and schizopods.

CLYDE.—Loch Fyne, near Crossaig, 29th April 1905 :—88 W. Spt., 22 to 28 cm. : eggs, ·1–·17 : fat, none, some. Some of the spents are beginning to lay up abdominal fat. The stomachs were large and full of copepods.

CLYDE.—Loch Fyne, Tarbert, 22nd April 1905 :—9 W. Spt., 21 to 25 cm. : t, 3 mm. : fat, none.

CLYDE.—Loch Fyne, Tarbert, 27th April 1905 :—19 Imm., 17 to 21 cm. : eggs, ·1–·25 : o, 2–4 mm. : t, 2–4 mm. ; 2 S. Spr. ♂, 18, 19 cm. : t, 5 mm. ; 3 W. Spt., 19, 21 cm. : eggs, ·1 mm. : o, 6 mm. : t, 4, 5 mm.

CLYDE.—Loch Fyne, Ardrishaig, 4th April 1905 : —2 W. Spr. F., 27, 29 cm. (one partly spawned) : fat, none ; 6 W. Spt., 21 to 29 cm. : fat, none, a trace; 1 S. Spr. ♂, 22 cm.: fat, none. The sample consists of two classes of fish—one thin, the other class thicker in the body; *i.e.*, some of the spents have recovered to some extent.

CLYDE.—Loch Fyne, Kilmichael Beg, 23rd April 1906:—304 Imm., 14 to 23 cm.: eggs, ·05–·15 mm.: o, 1·5–5 mm.: t, 1–4 mm.: fat, some; 2 Imm. dev., 21, 22 cm.: eggs, ·25 mm.: t, 5 mm.: fat, some; 1 W. Spr. F. ♀, 22 cm.: eggs, 1·4 mm.; 2 S. Spr. ♂, 21, 22 cm.: t, 9, 10 mm.: fat, some; 127 W. Spt., 19 to 26 cm.: eggs, ·05–·15 mm.: o, 4–6 mm.: t, 4–7 mm.: fat, some. The stomachs contained copepods, and in some cases schizopods; only a few were empty. This sample of herrings was captured by Dr. Fulton.

EAST COAST.—Anstruther, 7th April 1905:—24 W. Spr. F., 21 to 27 cm.; 2 W. Spt., 23, 30 cm.: eggs, ·15 mm.

EAST COAST.—Aberdeen, 115 miles E.S.E. of, 24th April 1908:—5 Imm., 23 cm.: o, 1, 4 mm.: t, 3·5 mm.: fat, large quantity; 154 S. Spr., 21 to 27 cm.: eggs, ·2–·35 mm.: o, 3–7·5 mm.: t, 3–9 mm.: fat, from a large quantity to none—as a rule, very little, or none; 12 W. Spt., 21 to 26 cm.: eggs, ·2 mm: o, 4, and flabby condition: t, 5·5, and "skin" condition: fat, little or none. The stomachs were empty.

Summary.

IMMATURE.—14–24 cm.: eggs, ·05–·25 mm.: o, 1–5 mm.: t, 1–4 mm.: fat, some, great quantity. (*See* Analysis given below.)

IMM. DEV.—18, 21, 22 cm.: eggs, ·25 mm.; t, 5 mm.: fat, some.

S. SPR.—17–27 cm.: eggs, ·2–·35 mm.: o, 3–7·5 mm.: t, 3–10 mm.: fat, as a rule a little, but also large quantity, and none. (*See* Analysis given below.)

W. SPR. F.—20–27 cm.: eggs, 1·4 mm.

W. SPT.—19–30 cm.: eggs, ·05–·2 mm.: o, 4–15 mm.: t, 3–14 mm.: fat, none, some.

The herrings (immature, summer spawners, and winter spents) examined during this month are characterised by having a small amount of abdominal fat.

The immature herrings were got in Kilmichael Beg, while the summer spawners were obtained in the North Sea. On reference to the table it will be seen that the immature herrings measured from 14 to 24 cm. in length. These I regard as winter-spawning herrings, which will spawn for the first time in the following winter. The winter spawners of the past winter are represented by the spents measuring from 19–30 cm. This lot contains the first spawning group. In Kilmichael Beg the winter spents measured from 19 to 26 cm. There is therefore a year's difference in age between the immature and the winter spents. The summer spawners measure from 17 to 27 cm. They will probably spawn for the first time within three or four months. In age they come about midway between the immature and winter spents. Taking the age of the winter-spawning herring from February, I regard the immature herrings as being fourteen months old, the winter spents as two years and two months, while the summer spawners, counting from the month of August, are twenty months old (*vide* p. 57). Now in the matter of the abdominal fat, the immature and summer spawners are little better than the winter spents. The immature are beginning to store up fat; some have already a large quantity, but most have little. The winter spents show a similar condition. During the summer the winter spents and immatures will store up much fat and become "matjes"—that is, very fat herrings having small reproductive organs which are about to ripen. The herrings have probably been growing since the winter. The summer spawning herrings will not lay up abdominal fat at this season, since the food material will be required for forming the roe and milt. The rate of growth is discussed at pp. 57 to 64. The analysis of the herrings from the standpoint of the amount of abdominal fat is given in the following table:—

Abdominal Fat.

Length.	IMMATURE.			S. SPR.			W. SPT.	
	Large Quantity.	Some.	Practically None.	Large Quantity.	Some.	None.	Some.	Practically None.
cm.								
14	2	5	1	..	..	..	..	..
15	3	8	2	..	..	..	..	..
16	6	3	4	..	..	..	..	..
17	2	5	2	..	..	..	..	..
18	1	8	3	..	..	..	..	..
19	..	28	5	..	..	..	..	1
20	..	64	14	..	..	..	2	..
21	..	60	20	..	..	1	10	9
22	1	15	12	2	6	5	18	7
23	..	4	1	8	21	15	20	6
24	1	..	..	12	23	20	14	7
25	..	..	..	2	11	16	3	4
26	..	..	..	..	4	4	2	..
27	..	..	..	..	..	1	..	..

The *Winter Spents* show various stages of recovery after spawning. Some ovaries and testes are flabby, skin-like; others are shrinking and filling; some have shrunk to a small size. In a sample of herrings different states of the reproductive organs may be found, showing that the herrings represented there had spawned at different times. Old unspawned ripe eggs were observed in several ovaries. They were to be detected even in shrunken ovaries. Some of the ovaries are becoming plump, although soft.

On cutting a transverse section of a spent ovary a wide lumen is usually found in the oviduct. In one female 27 cm. long the new crop of eggs (of which the largest measured ·17 mm. diameter) was being formed. The ovary was not, however, filled up; there was room between the eggs.

Traces of fat folds appear in the abdomen in some of the spents.

Winter Spawners.—The winter spawners were full, in some cases partly spawned.

[TABLE

Herrings from the Clyde.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
14	12, 20	..	..	..
15	15–19	..	1·5	·05
16	14–28	..	..	·05
17	21–29	<·1	2, 3	·05
18	22–37	<·1, ·1	1–3	·05–·2
19	29–49	<·1, ·1	1·5–3	·1, ·15
20	31–54	<·1, ·1	1·5–8	·05, ·15
21	29–59	<·1, ·1	1–10	·05–·25
22	36–74	<·1–6·8	2·5–9	·05–·25, 1·4
23	45–88	<·1–1·1	1–12	·05–·25
24	49–96	·2–·8	4–13	·05–·35
25	62–107	·1 ·5	4–13	·05–·25
26	58–107	·4	7–14	·1
27	76–137	..	12, 20	·17
28	67	..	..	..
29	88	..	..	..
30	78	..	..	..

Herrings from the neighbourhood of Ardrishaig (*including Inverneil Bay, Castleton Bay*), *between March 30th and May 5th 1905.*—They were as follows:—

66 Imm., 16–32 cm.: eggs, ·15 mm.: o, 3, 4 mm.: t, 1·5–4 mm.: fat, large quantity, none; 6 W. Spr. F., 28, 29 cm.: o, 21 mm.: t, 20–27 mm.: fat, none; 19 W. Spt., 20–30 cm.: eggs, ·15 mm.: o, 3·5–9 mm.: t, 2–11 mm.: fat, much, practically none; 3 S. Spr. ♂, 22, 27 cm.: t, 7–12 mm.: fat, none.

Only one full female was obtained; it was partly spent. Five full males were obtained; one was partly spent.

Of the full herrings five had empty stomachs. In three the stomach was shrunken. Some immature herrings had stomachs full of copepods; one or two had empty stomachs, while in the case of four the stomach was shrunken.

MAY.

CLYDE.—Campbeltown, off Brown Head, 15th May 1907:—52 W. Spt., 24 to 28 cm.: eggs, ·12–·2 mm.: o, 5–8 mm.: t, 4–7 mm.: fat, a little, none; 1 S. Spr. ♀., 24 cm.: eggs, ·75 mm.: o, 11 mm.: fat, none. Some of the stomachs were full of copepods: others were empty. Some pelagic fish-eggs were seen in one stomach.

CLYDE.—Campbeltown, Machrie Bay, Arran:—73 W. Spt., 23 to 27 cm.: eggs, ·2 mm. The stomachs contained copepods.

CLYDE.— ? 30th May 1908:—96 W. Spt., 22 to 29 cm.: eggs, ·1 and ·15 mm.: o, 5 mm.: t, 4 mm.: fat, some, much. The stomachs were full of copepods and schizopods.

CLYDE.—Loch Fyne, between Skipness and Laggan, 11th May 1909:—17 Imm., 19 to 25 cm.: eggs, ·17–·2 mm.: o, 3 and 4 mm.: t, 2–4 mm.: fat, much, none; 1 S. Spr. ♀., 21 cm.: eggs, ·5 mm.: o, 4 mm.: fat, much; 76 W. Spt., 21 to 30 cm.: t, 4 mm.: fat, none, some. The stomachs were full of copepods.

Clyde.—Loch Fyne, 1 mile S. of Tarbert, 15th May 1906:—1 Full herring, ♂, nearly ripe, 25 cm.: t, 24 cm.: fat, practically none; 45 Imm., 18 to 23 cm.: eggs, ·1–·2 mm.: o, 1·5–4 mm.: t, ·2–4 mm.: fat, much, some; 21 W. Spt., 21 to 24 cm.: eggs, ·05–·15 mm.: o, 2·5–8 mm.: t, 5 and 6 mm.: fat, much, some. In most cases the stomachs contained copepods.

Clyde.—Loch Fyne, Ardrishaig (?), 14th May 1908:—6 Imm., 19 to 23 cm.: eggs, ·15 mm.: t, 2–3·5 mm.: fat, large quantity, some; 1 S. Spr. ♀., 20 cm.: eggs, ·27 mm.: o, 4 mm.: fat, much; 90 W. Spt., 20 to 27 cm.: eggs, ·12–·2 mm.: o, 3–8 mm.: t, 3–5 mm.: fat, some, much, none. The stomachs were empty in some fishes; food was found in certain cases.

Clyde.—Loch Fyne, near Ardrishaig, 7th May 1908:—1 Imm. ♀., 14 cm.: eggs, ·1 mm.: fat, a little; 14 W. Spt., 20 to 28 cm.: eggs, ·1, ·12 mm.: fat, a little, none. The stomachs, with two exceptions, were empty; these were filled with copepods and schizopods.

Clyde.—Upper Loch Fyne, 23rd May 1906:—1 Full herring, ♀., 18 cm.: eggs, 1·1 mm.: ovary, 9 mm. [This fish seemed to be partly spent.] 139 Imm., 15 to 22 cm.: eggs, ·1, ·15 mm.: t, 7, and flattened: fat, large quantity (in one case, a trace of fat only); 3 W. Spt. ♀., 21, 22 cm.: old eggs in ovary in one case: o, 7 mm., thin skin condition: fat, much. The stomachs were, with a few exceptions, full of copepods; the few exceptions were empty.

Clyde.—Upper Loch Fyne, 19th May 1905:—1 Full herring, ♂., 35 cm.; 1 W. Spt. ♀., 35 cm.

West Coast.—Stornoway, 20 miles N. of Rona, 26th May 1905:—11 Imm., 20 to 25 cm.: eggs, ·1–·15 mm.: o, 4, 5 mm.: t, 3, 5 mm.; 11 S. Spr., 22 to 25 cm.: eggs, ·3–·5 mm.. t, 9, 10 mm.; 3 Full herrings, 25, 26 cm. (one ♂, 26 cm., was partly spawned); 22 W. Spt., 22 to 26 cm.: eggs, ·15–·25 mm.: t, 6–13 mm.

West Coast.—Stornoway, 17th May 1907:—1 S. Spr. ♀. 28 cm.: eggs, ·7 mm.: o, 14 mm.: fat, much; 48 W. Spt., 26 to 30 cm.: eggs, ·1, ·15 mm.: o, 6–8 mm.: t, 8 mm.: fat, large quantity, some. There was food present in some stomachs.

East Coast.—Aberdeen Bay, 15th May 1902:—22 Imm., 12 to 16 cm.: o, 2 mm.: t, 1·5 mm.: fat, large quantity, some.

East Coast.—Aberdeen, 40 miles E. by N. of Buchan Ness, 15th May 1908:—49 S. Spr., 22 to 27 cm.: eggs, ·25–·4 mm.: o, 5–14 mm.: t, 4–14 mm.: fat, some, much, none. Some of these herrings had the stomach full of copepods and schizopods; others had empty stomachs.

Summary.

Immature.—12–25 cm.: eggs, ·1–·2 mm.: o, 1·5–5 mm.: t, 2–5 mm.: fat, "a little" to "large quantity."

Full.—18–26 cm.: eggs, 1·1 mm.: o, 9 mm.: t, 24 mm.: fat, practically none.

W. Spt.—20–35 cm.: eggs, ·05–·25 mm.: o, 2·5–8 mm.: t, 4–13 mm.: fat, from "none" to "a large quantity" (Stornoway).

S. Spr.—20–28 cm.: eggs, ·25–·5, ·7, ·75 mm.: o, 5–14 mm.: t, 4, 14 mm.: fat, "none" to "much."

Immature.—The ovary was more or less solid. The testis was shreddy in structure. The amount of abdominal fat varied. In some it was large; in others it was practically absent.

Full.—Six full herrings were obtained; both sexes were represented. Certain of these were partly spawned.

S. Spr.—The ovary and testis were in many cases small but ripening. The ovary was red or pink in colour, clear, plump, and soft. The eggs are yolked. When the eggs were ·25 it was possible in some cases to detect the small opaquish eggs with the naked eye. White vessels are visible in the ovary, which is elastic in nature. The ovary soon becomes opaque in formaline solution, showing that it contains an albuminous fluid.

The testis is clear, pink, soft, and sometimes shows longitudinal wrinkles on its flat side. When teazed in fresh water it gets opaque owing to the coagulation of its fluid. It is filled with this fluid, which, when the testis is cut, oozes out and coagulates to a fine white powdery precipitate. If the portion of tissue is washed well in water a shreddy and sometimes the honeycomb structure is visible.

The abdomen is slack.

Winter Spent.—The reproductive organ may be flabby, thin, or shrunk, skin-like. When it begins to develop again it becomes plump, clear, and red or pink in colour. The stroma is gauzy, loose, with the eggs scattered through it, not packed close together. Eggs in the process of division are present. There is a considerable lumen in the ovary; the oviducal part is wide. As a rule there were no yolked eggs in these spents. A certain amount of white matter (coagulated albuminous fluid) comes out when the ovary is teazed in water. The testis may be flabby, pink, soft, shrunk, small, or skin-like. The outside skin may be deeply wrinkled. The testis, although shrivelled, shows the honeycomb or sponge structure. Some albuminous matter comes out of the tissue, which is shreddy.

The winter spents from Stornoway were very fat, much fatter than those from the Clyde.

Length.	Range of Weight.*	Weight of Reproductive Organs.*	Breadth of Reproductive Organs. †	Diameter of Eggs. †
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
12	..	..	2	..
13	..	..	..	..
14	..	..	1, 2	·1
15	17, 23	..	..	..
16	23, 28	..	..	·1
17	33, 37	..	..	..
18	30–48	·2, 1·1	3, 9	·15, 1·1
19	34–60	·1, ·2	1·5–4	·1–·2
20	33–67	·1, ·2	2–4	·15–·27
21	42–77	·1–·7	2·5–7	·1, ·15
22	52–77	·1–·3	2–7	·05–·25
23	52–96	·1–·3	2–6	·1–·3
24	64–104	·2, ·4	4–11	·1–·25, ·75
25	74–114	..	3–24	·1–·4
26	95–128	..	4–10	·1–·3
27	110–162	..	5–12	·15–·35
28	124–171	·6, 5	6–14	·1, ·15, ·7
29	143–172	..	..	..
30	154–178	..	..	·1
35	295, 379	..	..	..

* Herrings from Clyde and West Coast.

† Herrings from Clyde, West Coast, and East Coast.

Herrings from Ardrishaig, Loch Fyne, date ? April or May

204 Imm., 16 to 23 cm. : eggs, ·05–·25 mm. : o, 2–4 mm. : t, 2–5 mm. : fat, large quantity, but in some cases only a little or none; 1 Full, ♀., 21 cm. : eggs, 1·0 mm. : fat, little or none; 24 W. Spt., 18 to 23 cm. : eggs, ·1, ·15 mm. : o, 3–10 mm. : t, 4–7 mm. : fat, as a rule a fair quantity, it varied from " much " to " a little " or "none." The fishes were feeding on copepods; a certain proportion had empty stomachs.

Table of the Sizes of the Herrings.

Length. *cm.*	Imm.	W. Spt.	Full ♀
16	1	..	..
17	4	..	..
18	17	1	..
19	48	..	..
20	79	1	..
21	43	5	1
22	9	12	..
23	3	5	..

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
17	37, 44	·1	3	·1
18	46–54	<·1, ·2	2–7	·15
19	43–61	<·1–·4	2–4	·1–·2
20	49–74	·1–·4	2–5	·1–·25
21	56–81	·1–·5	2–5	·1, ·15, 1·0
22	67–92	·1–·8	2–10	·05–·15
23	68–102	·2–1·1	2·5–7	·1

JUNE.

CLYDE.—Campbeltown, Davaar I., 4th June 1908 :—46 W. Spt. 23 to 29 cm.: eggs, ·12–·25 mm.: o, 4–15 mm.: t, 3–11 mm.: fat, large quantity, some; 1 S. Spr. ♀, 27 cm. : eggs, ·35 mm. : fat, some. The stomachs contained food; in some cases they were full.

CLYDE.—Campbeltown, Saddel Bay, 6th June 1907 :—83 W. Spt., 21 to 28 cm. : eggs, ·1–·2 mm. : o, 4–6 mm. : t, 2–5 mm. : fat, great quantity; 3 S. Spr., 23, 24 cm. : eggs, ·3, ·4 mm. : fat, great quantity. These herrings appeared to be spents. They may have been summer (autumn) spents. The stomachs contained copepods.

CLYDE.—Campbeltown, 7 miles S.W. of Sanda, 18th June 1908 :—55 W. Spt., 21 to 27 cm. : eggs, ·15, ·2 mm. : o, 4–10 mm. : t, 3–9 mm. : fat, great quantity; 4 S. Spr., 26, 27 cm. : eggs, ·3–·55 mm. : o, 9–16 mm. : t, 12 mm. : fat, great quantity, much. Some had food in the stomach; others had none.

CLYDE.—Campbeltown, Brown Head, Arran, 20th June 1907 :—84 W. Spt., 22 to 28 cm. : eggs, ·12–·25 mm. : o, 2–6 mm. : t, 2–6 mm. : fat, great quantity; 1 S. Spr. ♀, 25 cm.: eggs, ·4 mm.: o, 10 mm.: fat, great quantity; 3 Unclassified, 24 cm.: o, 7 mm.: fat, great quantity.

Clyde.—4 miles W.N.W. of Girvan, 1st June 1906:—48 Imm., 19 to 27 cm.: eggs, ·1–·2 mm.: o, 2·5–6 mm.: t, 2–8 mm.: fat, great quantity, some; 20 W. Spt., 23 to 25 cm.: eggs, ·1, ·15 mm.: o, skin-like, 7–10 mm.: t, skin-like, 5–9 mm.: fat, great quantity, a little; 1 S. Spr. ♀, 23 cm.: eggs, ·35 mm.. o, 8 mm.: fat, great quantity; 16 Unclassified, 21 to 26 cm.: eggs, ·1, ·15 mm.: o, 5–8 mm.: t, 5 mm.: fat, great quantity, some. The stomachs were full of copepods.

Clyde.—Rothesay Bay, 1st June 1906:—89 Imm., 15 to 21 cm.: eggs, ·1 mm.: o, 4 mm.: fat, much. Most of the fishes had stomachs full of copepods.

Clyde.—Loch Fyne, between Laggan and Tarbert, 23rd June 1908:—70 W. Spt., 24 to 29 cm.: eggs, ·1–·25 mm.: o, 7–15 mm.: t, 6–10 mm.: fat, great quantity.

Clyde.—Loch Fyne, south of Tarbert, 13th June 1906:—56 Imm., 18 to 23 cm.: eggs, ·1–·25 mm.: o, 2–5 mm.: t, 2–5 mm.: fat, great quantity, some; 16 W. Spt., 19 to 25 cm.; eggs, ·1–·2 mm., o, 2–7 mm.: t, 5 mm.: fat, large quantity; 17 Unclassified, 19 to 24 cm.: eggs, ·1, ·2 mm.: o, 3–5 mm.; t, 5 mm.: fat, large quantity. The stomach contained copepods in many cases; about half the total number were empty.

Clyde.—Loch Fyne, Otter, 20th June 1907:—1 S. Spr. ♀, 24 cm.: eggs, 5 mm.: o, 5 mm.: fat, great quantity; 11 W. Spt., 21 to 25 cm.: o, 3–10 mm.: t, 3–6 mm.: fat, great quantity. Stomachs empty.

Clyde.—Loch Fyne, Lochgair, 1st June 1906:—38 Imm., 18 to 23 cm.: eggs, ·1–·2 mm.: o, 3, 4 mm.: t, 2–6 mm.: fat, great quantity; 15 W. Spt., 20 to 25 cm.: eggs, ·1, ·15 mm.: o, 5 and 6 mm.: t, 5 mm.: fat, great quantity; 20 Unclassified, 19 to 23 cm.: t, 5 mm.: fat, great quantity; 1 S. Spr. ♀, 23 cm.: eggs, ·3 mm.: o, 5 mm.; fat, great quantity. The stomachs, with a few exceptions, contained copepods; a small proportion were empty.

Clyde.—Upper Loch Fyne, 9th June 1906:—64 Imm., 16 to 21 cm.: eggs, ·1–·25 mm.: o, 2–4 mm.: t, 1·5–4 mm.: fat, great quantity; 4 S. Spr., 18 to 20 cm.: eggs, ·35 and ·4 mm.: o, 4 and 5 mm.: t, 6 and 7 mm.: fat, great quantity; 3 W. Spt., 21, 22 cm.: eggs, ·1, ·15 mm.: o, 4, 6 mm.: fat, great quantity. The stomachs were, with three exceptions, empty; three contained copepods.

West Coast.—Off Lochboisdale, ½ mile from shore, 19th June 1906:—68 Imm., 22 to 28 cm.: eggs, ·1–·25 mm.: o, 2·5–5 mm.: t, 3–7 mm.: fat, large quantity, some; 25 W. Spt., 23 to 29 cm.: eggs, ·2, ·25 mm.: o, 5–8 mm.: t, 8 mm.: fat, large quantity; 8 S. Spr., 23 to 27 cm.: eggs, ·3–·4, 1·1 mm.: o, 5–15 mm.: t, 13, 14 mm.: fat, large quantity; 6 Unclassified, 24 to 27 cm.: eggs, ·15 mm.: o, 5 mm.: t, 6 mm.: fat, large quantity. One of the S. Spr., viz., a ♀, 25 cm., was full. The stomachs contained copepods, in some cases in large quantity; a few stomachs were empty.

West Coast.—½ mile off Knock, Lewis, 28th June 1906:—8 Imm., 23 to 26 cm.: eggs, ·15, ·25 mm.: o, 4 mm. broad; t, 3–4 mm.: fat, great quantity; 7 W. Spt., 25 to 27 cm.: eggs, ·1–·3 mm.: o, 5–9 mm.: t, 5–7 mm.: fat, great quantity; 12 S. Spr., 22–27 cm.: eggs, ·3–·6 mm.: o, 5–12 mm.: t, 8–15 mm.: fat, large quantity, a little; 6 Unclassified, 25 and 26 cm.: t, 6–12 mm.: fat, great quantity. The food found in the stomachs was copepods, larvæ of decapod crustacea, sand-eels (ammodytes sp.).

West Coast.—Stornoway, 1–3 miles off Tiumpan Head, 21st June 1907:—41 W. Spt., 24 to 31 cm.: eggs, ·15–·25 mm.: o, 3–8 mm.: t, 5, 7 mm.: fat, great quantity; 1 S Spr. ♀, 26 cm.: eggs, ·45 mm.: o, 11 mm.: fat great quantity; 2 Full herrings, ♂, half-spawned, 26, 27 cm.: fat, none, a little; 2 Unclassified, ♀, 27, 28 cm.: fat, great quantity. The food consisted of schizopods; some stomachs were empty.

East Coast.—Firth of Forth, 5th June 1903:—23 Imm., 10–14 mm.: fat, great quantity to little or none; 8 Imm., 17 to 20 cm.: eggs, ·15, ·2 mm.: o, 2·5, 3 mm.: t, 2, 3 mm.: fat, large quantity to none.

East Coast.—Aberdeen, 90 miles east of, 5th June 1908:—23 Spents (previous summer), 23 to 26 cm.: eggs, ·25–·4 mm.: o, 7–11 mm.: t, 6–10 mm.: fat, large quantity, some; 8 S. Spr., 23 to 26 cm.: eggs, ·32–·4 mm.: o, 7–11 mm.: t, 6·5–15 mm.: fat, large quantity, some: one of these S. Spr. was a "full" male. In the majority the stomachs were empty; some contained copepods.

East Coast.—Aberdeen, 19th and 23rd June 1908:—4 Spents (previous summer), ♀, 24, 25 cm.: eggs, ·27–·5 mm.: o, 6–10 mm.: fat, much, some; 4 S. Spr., 24 to 26 cm.: eggs, ·35, ·7 mm.: o, 9, 16 mm.: t, 8, 14 mm.: fat, large quantity, a little. Crustacea were found in one stomach; the other stomachs were empty.

East Coast.—Peterhead, 42 miles N. by E., 20th June 1906:—29 Spents, 22 to 25 cm.: eggs, ·15 to ·3 mm.: o, 5–10 mm.: t, 5 to 10 mm.: fat, large quantity, very little; 12 S. Spr., 22 to 25 cm.: eggs, ·3–·5 mm.: o, 5–9 mm.: t, 6–25 mm.: fat, large quantity, practically none; 11 Unclassified, 22 to 25 cm.: eggs, ·25 mm.: o, 3–7 mm.: t, 4–6 mm.: fat, large quantity, some. The majority had empty stomachs; a few had a little food in the stomach. Some of the S. Spr. may be summer spents (of last year), while the Spents probably consist of the same class.

East Coast.—Wick, 30 miles E. by N. of, 28th June 1906:—5 Imm. dev., 22 to 24 cm.: eggs, ·3 mm.: o, 6 mm.: t, 3, 5 mm.: fat, large quantity, some; 22 Spents, 22 to 25 cm.: eggs, ·2–·5 mm.: o, 5–9 mm.: t, 5–13 mm.: fat, large quantity; 9 S. Spr., 22 to 25 cm.: eggs, ·35–·45 mm.: o, 5–7 mm.: t, 16, 20 mm.: fat, large quantity, a little: 5 Unclassified, 21 to 24 cm.: t, 6 mm.: fat, large quantity. Some stomachs were empty; others contained copepods. These herrings were fat, but not so fat as the Castlebay herrings. As to the exact description of the "Spents," it is difficult to decide to what spawning they belong. They were to all appearance spent fishes, that is, so far as the reproductive organs went; but all, even those with eggs as small as ·2 mm., had a large quantity of abdominal fat. One of these having eggs ·2 mm. I had described as "apparently just spent." It is no doubt a winter spent, or may be a spring spent, while those having larger eggs might be autumn or early winter spents. One of the S. Spr., a male, was a full herring.

East Coast.—Lerwick, 50–70 miles E. of Bressay, 29th June 1906:—1 Imm., 27 cm.: fat, large quantity: 9 Spents, 25 to 27 cm: eggs, ·2–·5 mm: o, 5–14 mm.: t, 17 mm.: fat, large quantity, some; 31 S. Spr. dev., 24 to 27 cm.; eggs, ·3–·8 mm.: o, 7–22 mm.: t, 7–17 mm.: fat, large quantity, some; 3 S. Spr. F., 26, 27 cm: t, 20 mm.: fat, large quantity; 5 Unclassified, 26, 27 c.m.: eggs, ·2 mm.: o, 2, 5 mm.: t, 4, 7 mm.: fat, large quantity. Most of the stomachs were empty; a few copepods were found in three stomachs. Some of the spents appeared to be "just spent." One ♂ was partly spent.

Immature.—10 to 28 cm.: eggs, 1–·25 mm.: o, 2–6 mm.: t, 2–8 mm.: fat, from "a great quantity," to "little or none."

Imm. Dev.—22 to 24 cm.: eggs, ·3 mm.: o, 6 mm.: t, 3, 5 mm.: fat, large quantity, some.

W. Spt.—19 to 31 cm.: eggs, ·1–·3 mm.: o, 4–15 mm., skin-like: t, 1·5–11 mm., skin-like: fat, "large quantity" to "very little."

Spents (previous summer or autumn)—22 to 27 cm.: eggs, ·25–·5 mm.: o, 5–14 mm.: t, 5–17 mm.: fat, "large quantity," "some."

S. Spr.—18 to 28 cm.: eggs, ·3–·8, 1·0 mm.: o, 4–22 mm.: t, 6–25 mm.: fat, "great quantity" to 'practically none."

Unclassified, 19 to 28 cm.: eggs, ·1–·25 mm.: o, 2–8 mm.: t, 4–12 mm.: fat, "great quantity" to "some."

Summer Spents.—The summer spents of last year are becoming summer spawners. The fishes which have been diagnosed as summer spents were slack in the belly; the reproductive organ showed "spent" characters, although the eggs were developing. There was generally a large quantity of abdominal fat present. The ovary was reddish in colour, plump, filled, but soft. The ridges were filled with eggs, some of which were storing up yolk, while the majority remained smaller and clear. When the ovarian tissue is teazed the very small yolked eggs can be detected as white grains in the tissue. They can be recognised by the naked eye when ·27 mm. in diameter, though sometimes, although bigger, they may not be satisfactorily made out. In two summer spawners, 23 and 24 cm. long, having eggs ·3 mm. in diameter, old follicles were detected, an indication of the fishes having spawned before.

The testis is pink in colour, and has a thin edge. When teazed out and washed in water a shreddy honeycomb structure can be made out.

Winter Spents.—There is difficulty in separating the summer spents of last year from the winter spents of the present year. Possibly some of those which appear to be advanced winter spents may belong to the former class. In June few herrings below 20 and 21 cm. in length should be winter spents, because, although they spawn when under that size, they should by that time have probably reached that size. The summer spent is simply a certain distance ahead of the winter spent in its ripening. The summer spent might occupy the position of the more precocious winter spents.

The rule I have followed has been to regard those having eggs ·3 mm. and over in diameter as summer spawners, more especially if the other fishes in the series showed reproductive organs farther advanced than that; while if the majority of the sample had eggs smaller than ·3 mm., with a few reaching that size, then I have regarded the lot as winter spent. The two classes will probably overlap and mix. The late summer spents and the early winter spents will, one expects, spawn at the same time, probably as autumn spawners.

The condition in which the reproductive organ is a flat, red, dry skin, is apparently a resting stage, during which the fish grows in length and stores up abdominal fat. Some fishes had clear crystalline concretions in the ovaries; they appeared to be in some cases old eggs. But clear concretions were also found in some very small testes. Budding was apparently taking place in some ovaries. When a piece of an ovary is crushed on a slide beneath a cover glass old follicles are sometimes to be seen in a dark roll shape, occasionally semi-circular in form, surrounding a young egg.

The testis of the winter spent was pink in colour, narrow, shrunken, with sometimes a thin edge, and a shreddy honeycomb structure filled with coagulable albuminous fluid. In some the remains of pouches can be made out. The elastic honeycomb sponge structure is getting filled up. The testis is sometimes a flattened skin. There are crystalline concretions in the testis. Might the unspawned milt assume this form?

There are apparently several distinct stages in the spent reproductive organ. Immediately after spawning it is a loose, flabby, skin-like bag. It gradually shrinks while the new crop of eggs is being formed. It may become a narrow, flattened, thin, dry skin, containing the new crop of eggs. Old follicles were made out in ovaries of this character. When the ovary begins to develop it swells out, is soft, and is roomy inside. The soft, clinging nature of the stroma is characteristic of this stage. Eggs ·2 mm. in diameter were found in one of these ovaries. The eggs were fairly uniform in size. The ovary may be red in colour, and narrow. In a narrow spent ovary having eggs ·15 mm. in diameter there was an apparently big range of size among the eggs. The yolked eggs became visible to the naked eye as white granules in the ovarian tissue when about ·3 mm. in diameter.

During the month most of the spents had a large quantity of abdominal fat. The spents got at Laggan, Loch Fyne, appeared to be, on the whole, fatter than those got at Sanda, Campbeltown. Among the herrings got at the latter place the smaller herrings have comparatively the greater quantity of fat, but their reproductive organs are not further advanced than those of the larger herrings.

Summer Spawner.—An ovary containing eggs ·35 mm. in diameter was red in colour and soft. A whitish network was visible in the stroma. A large proportion of the eggs were clear, only a small proportion being yolked. This fish had probably spawned before. A testis was plump, tense, pink or white in colour. The honeycomb structure is filled with corpuscles. In a testis 15 mm. wide, which was nearly ripe, there was an albuminous, corpusculated matter.

Nine full herrings, viz., 1 ♀ and 8 ♂, were obtained.

Immature.—The immature condition is shown in a small, firm, compact reproductive organ. The fishes from the Clyde classified during June as immature did not exceed 23 cm. in length, but some from Castlebay measured up to 28 cm. in length. Except in the case of a few specimens, the immature herrings had a large quantity of fat.

In many cases it was difficult to get the actual measurement of the eggs, because the ovaries were often saturated with oil from the abdominal fat. It is not therefore possible to insist strongly on measurements to ·1 mm. in the case of the largest eggs in the ovary, as they were inclined, under these conditions, to swell up. When the eggs are all very small, as, for example, when the ovary is about to ripen, the large eggs may be few in number, and here *post-mortem* changes may give a larger size than is warranted to these eggs. Where the ovary contains a large quantity of yolked eggs, an average size of these is taken to represent the ovary. The error is likely to be comparatively larger in the very small ovaries than in the large.

Herrings from Clyde, West Coast, and East Coast.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
15	27	. .	. .	. .
16	30, 33	<·1	2	. .
17	21–46	<·1, ·1	1·5, 2	·1
18	24–63	·1–·3	2–7	·1–·2
19	33–64	·1–·3	1·5–5	·1–·35
20	51–76	·1–·7	2–6	·1–·4
21	50–86	<·1–·4	2–5	·1–·25
22	52–115	<·1–9·7	2–25	·1–·4
23	60–127	·1–2·3	2–13	·1–·4
24	54–140	·1–13·5	2–20	·1–·5, ·7, ·8
25	84–161	·1–11	3–20	·1–·7, 1·0
26	86–171	·3–10	4–20	·1–·6
27	98–200	·3–14	2–22	·12–·5, ·7, ·8
28	154–200	·4, ·8	5–10	·15, ·2
29	164–230	·9, 1·5	6–9	·2
30	192–219	. .	. .	. .
31	199	. .	. .	. .

July.

Clyde.—Campbeltown, Brown Head, Arran, 5th July 1907 :—74 W. Spt., 22 to 28 cm. : eggs, ·15–·35 mm. : o, 3·5–12 mm. : t, 3–12 mm. : fat, great quantity ; 6 W. Spr., 24 to 26 cm. : eggs, ·25, ·3 mm. : o, 6–9 mm. : fat, great quantity. In most herrings the stomach was empty ; there were traces of food in some.

Clyde.—Campbeltown, 9th July 1908 :—47 W. Spt., 21 to 28 cm. : eggs, ·15–·35 : o, 4–10 mm. : t, 3–15 mm. : fat, large quantity, one had "a little" : 9 S. Spr., 22 to 26 cm.: eggs, ·45–·75 mm.: o, 9–13 mm.: t, 16, 18 mm. : fat, large quantity, "none."

Clyde.—Campbeltown, Arran Shore, 26th July 1907 :—36 W. Spt., 22 to 27 cm. : eggs, ·15–·3 mm. : o, 4–10 mm. : t, 2·5–15 mm. : fat, great quantity ; 2 S. Spr., 24, 25 cm. (of these, one is a full male) : eggs, ·5 mm. : o, 9 mm. : t, 20 mm. : fat, large quantity, "practically none" ; 17 W. Spr., 21 to 26 cm. : eggs, ·15–·35 mm. : o, 3–7 mm. : t, 2·5, 3 mm. : fat, large quantity. Some had a large amount of food (copepods) ; others had empty stomachs.

Clyde.—Campbeltown, 29th July 1908 :—48 W. Spt., 21 to 27 cm. : eggs, ·12 mm. : o, 2–6 mm. : t, 2–10 mm. ; 3 S. Spr. ♂., 23, 24 cm. : t, 14 mm. All have a great quantity of fat.

Clyde.—Kilbrennan Sound, July 1905 :—170 W. Spr. (including W. Spt.), 20 to 26 cm. : eggs, ·1–·35 mm. ; o, 2–10 mm. : t, 2–9 mm. : fat, great quantity, some ; 25 S. Spr., 23 to 26 cm. : eggs, ·4, ·7 mm. : o, 5–15 mm. : t, 10–19 mm. : fat, great quantity. Some had large stomachs full of copepods and schizopods ; others had their stomachs empty, in some cases shrunken.

Clyde.—Kilbrennan Sound, Pirnmill, 30th July 1908 :—72 W. Spt., 23 to 28 cm. : o, 3 mm. : t, 3, 4 mm. : fat, great quantity. Some had copepoda in the stomach ; others had none.

Clyde.—Off Sannox, Arran, 25th July 1905 :—49 W. Spr., 19–25 cm. : eggs, ·1–·3 mm. : o, 3–6 mm. : t, 2–8 mm. : fat, large quantity ; 4 S. Spr., 22–23 cm. : eggs, ·4–·6 mm. : o, 8–20 mm. : t, 10 mm. There were traces of food in the alimentary canal.

Clyde.—Rothesay, Ascog Bay, 8th July 1907 :—31 W. Spt., 18 to 22 cm. : eggs, ·1–·25 mm. : o, 2·5–5 mm. : t, 2–4 mm. : fat, great quantity ; 21 W. Spr., 18 to 21 cm. : eggs, ·12–·25 mm. : o, 2–4 mm. : t, 2–3 mm. : fat, great quantity. Most of these herrings had stomachs filled with crustacea ; some had empty stomachs.

Clyde.—Upper Loch Fyne, July 1905 :—8 W. Spt., 24 to 30 cm. : eggs, ·35, ·4 mm. : o, 4–15 mm. : t, 4–15 mm. : fat, great quantity ; 54 W. Spr., 20 to 31 cm. : eggs, ·25–·35 mm. : o, 4–11 mm. : t, 3–10 mm. : fat, great quantity ; 103 S. Spr., 26 to 33 cm. : eggs, ·4–·8, 1·2 mm. : o, 8–25 mm. : t, 10–30 mm. : fat, much. Of the summer spawners, 37, viz., 1 ♀ and 36 ♂, are full herrings. As a rule there were only traces of feeding.

Clyde.—Upper Loch Fyne, 28th July 1906 :—18 W. Spt., 20 to 24 cm. : eggs, ·15–·3 mm. : o, 5–10 mm. : t, 4, 5 mm. : fat, great quantity ; 35 W. Spr., 20 to 25 cm. : eggs, ·1–·25 mm. : o, 4–6 mm. : t, 2–5 mm. : fat, great quantity ; 1 S. Spr. ♀, 23 cm. : eggs, ·55 mm. : o, 11 mm. : fat, great quantity. The stomachs contained no food, but the herrings had been feeding recently.

East Coast.—Eyemouth, 20 miles E.N.E., 11th July 1906 :—4 Imm. ♂, 21–23 cm. : t, 3, 4 mm. : fat, large quantity, some ; 2 Spents (S. Spt. of previous year) ♂, 22, 23 cm. : t, 18 mm. : fat, large quantity, some ; 45 S. Spr., 21 to 26 cm. : eggs, ·25–·7, 1·0 mm. : o, 4–20 mm. : t, 5–26 mm. : fat, large quantity to practically none. Of the summer spawners 6 were full herrings. The herrings had been feeding on copepods; some stomachs were, however, empty.

East Coast.—Aberdeen:—13 W. Spt., 23 to 26 cm.: eggs, ·15, ·35 mm.: o, 4–8 mm.: t, 7–16 mm.: fat, great quantity; 1 W. Spr. ♀, 22 cm.: o, 8 mm.: fat, great quantity; 19 S. Spr., 23 to 28 cm.: eggs, ·4–·6 mm., ·95 mm.: o, 9–24 mm.: t, 11–30 mm.: fat, great quantity, "a little." These herrings had been feeding.

East Coast.—Aberdeen, 54 miles S.E. by E. of, 28th July 1908:—2 W. Spt. ♂, 25 cm.: t, 12, 13 mm.: fat, a trace, or none; 18 S. Spr., 24 to 28 cm.: eggs, ·4–·9 mm.: o, 10–27 mm.: t, 20 (and over) mm.: fat, large quantity to "none." Of the S. Spr., 11 were full herrings. The stomachs, with one exception, contained no food.

East Coast.—Peterhead, 14 miles off, 34 fms., 24th July 1906:—2 W. Spt., 23, 35 cm.: eggs, ·1 mm.: fat, one had a large quantity, the larger had no fat; 46 S. Spr., 23 to 27 cm.: eggs, ·6–1·0 mm.: o, 13–30 mm.: t, 16–30 mm.: fat, large quantity to "none." Of the summer spawners, 35 were full herrings. While some had no food in the stomach, others had. Certain of the full herrings did not seem to have been feeding just recently.

East Coast.—Lerwick, 50–70 miles East of Bressay, 16th July 1906:—4 Imm. dev., 26 to 30 cm.: eggs, ·25, ·35 mm.: o, 6, 8 mm.: t, 6 mm.: fat, large quantity; 19 Spents (S. Spt. of previous year), 26 to 29 cm.: eggs, ·3–·6 mm.: o, 8–17 mm.: t, 9–20 mm.: fat, large quantity; 20 S. Spr. (of these 4 were full herrings), 26 to 30 cm.: eggs, ·4–·8 and over: o, 10–22 mm.: t, 18–30 mm.: fat, large quantity, a little; 3 W. Spr. ♂, 27 cm.: t, 7 mm.: fat, large quantity, some. Some had food in the stomach; others had not.

Summary.

Imm. ♂.—21 to 23 cm.: t, 3, 4 mm.: fat, large quantity, some.

Imm. dev.—26–30 cm.: eggs, ·25, ·35: o, 6, 8 mm: t, 6 mm.: fat, large quantity.

W. Spt.—18 to 30 cm.: eggs, ·1–·4 mm.: o, 2–15 mm.: t, 2–16 mm.: fat, great quantity, none.

W. Spr.—18 to 31 cm.: eggs, ·05–·35 mm.: o, 2–11 mm.: t, 2–20 mm.: fat, great quantity, some.

Spents (of previous summer).—22 to 35 cm.: eggs, ·1, ·3–·6 mm.: o, 8–17 mm.: t, 9–20 mm.: fat, large quantity, none.

S. Spr.—21 to 33 cm.: eggs, ·4–1·0, 1·2 mm.: o, 4–31 mm: t, 5–30 mm.: fat, large quantity, none.

Winter Spent.—These herrings have, as a rule, a large quantity of abdominal fat.

The ovaries are usually small, thin, flattened, dry skin, sometimes embossed by the organs which have pressed upon them. They may be reddish in colour, and in the form of a narrow soft band, or they may be plump, with a comparatively large lumen inside. The septa and ridges bear the new crop of eggs. Egg-division was seen in some cases. In only one case was the flabby condition of the reproductive organ noticed. In one small ovary 4 mm. wide, the oviduct was folded longitudinally. The blood vessel was large. The eggs were irregular in size, the largest being ·17 mm. in diameter.

The testis is small, thin, flattened, skin-like. It may be narrow, red or pink in colour, and composed internally of a tough honeycomb spongy structure. The vas deferens is in some cases collapsed.

One or two cases occurred where the testes of what appeared to be winter spents were not completely spawned. The strands which form the walls of the honeycomb seemed to be broadening, and in this way the cavity was reduced in size.

The developing testis is pink.

Winter Spawner.—The herrings included under this denomination include doubtless both those that are preparing to spawn for the first time, and also winter spents.

Summer Spawner.—The developing testis shows the honeycomb structure, if a portion of it is teazed out and washed in water. In a full testis the honeycomb network is composed of extremely delicate strands. The outer skin of the large testis is also extremely thin. The tissue of a small testis may be comparatively tough.

There is difficulty in determining whether to designate late summer spawning herrings as actually belonging to the Summer Spawning group. Similarly in this month many of what are regarded as winter spawning herrings are so far advanced that they must almost of necessity spawn before winter, that is to say, in autumn.

An interesting comparison may be made between the herrings from the Clyde and those obtained on the East Coast. The comparison is made by means of the female specimens. They are contrasted according to the condition of development as shown in the size of the ova in the various individuals. The herrings are arranged in the following table, the number at each size being given :—

COMPARISON BETWEEN THE HERRINGS OF THE CLYDE AND EAST COAST in respect to the Development of the Ovary as shown by the Diameter of the Ova, in *mm.*

Length *cm.*	CLYDE.										EAST COAST.									
	·05	·1	·2	·3	·4	·5	·6	·7	·8	1·2	·1	2	·3	·4	·5	·6	·7	·8	·9	1·0
18	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	1	7	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	-	4	13	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	9	5	3	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
22	-	8	11	4	1	1	-	-	-	-	-	1	1	-	1	-	-	-	-	-
23	1	8	13	9	5	2	-	-	-	-	-	-	2	3	3	1	-	-	-	-
24	-	4	12	13	6	3	-	1	-	-	1	-	2	-	2	2	2	1	-	-
25	-	1	11	5	1	2	1	-	-	-	-	-	-	-	1	1	4	3	3	1
26	-	1	7	13	5	3	-	1	1	-	-	-	3	3	1	1	-	2	4	2
27	-	-	6	5	2	2	-	-	-	-	-	1	-	2	2	2	3	1	1	-
28	-	-	-	5	4	1	-	-	1	-	-	-	-	-	-	-	-	-	2	-
29	-	-	-	1	2	1	-	-	-	1	-	-	1	-	1	-	1	-	-	1
30	-	-	-	1	3	3	2	-	-	-	-	-	1	1	-	-	-	-	-	-
31	-	-	-	-	2	7	4	-	-	-	-	-	-	-	-	-	-	-	-	-
32	-	-	-	-	1	2	3	1	-	-	-	-	-		-	-	-	-	-	-
33	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-
34	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-

It is seen that the East Coast specimens are distinctly ahead of those from the Clyde in the development of the ovary. The range of the sizes of the eggs is in the former from ·1–1·0 mm., while that for the Clyde is from ·05–·8 mm., with one female carrying eggs 1·2 mm. in diameter. In the development of the ovary the two lots of herrings overlap. In each there is a mixture of winter and summer spawners, but so far as the material goes there is no sharp division between the winter and summer spawning herrings. There is no indication of any natural division.

Among the Clyde specimens the larger herrings were, on the whole, farther advanced than the smaller. Thus the herrings 18–27 cm. had eggs ·05–·8 mm. in diameter, while those measuring from 28 to 33 cm. had eggs ·3–.7, 1·2 mm. in diameter. The East Coast herrings were much fewer in number than those from the Clyde.

It is evident that in both regions there will be spawning spread over a long period, and, so far as can be judged, a considerable amount of spawning should occur during autumn, bridging the interval between the summer and winter spawnings. The winter spawning herring will probably require a longer time for the eggs to ripen. Thus those herrings which have eggs ·3 mm. in diameter will probably spawn during the autumn, while those herrings in which the ovaries are in the resting condition of, say, the winter spents, and having eggs ·15 and ·2 mm. in diameter, will not likely spawn till February.

Herrings from Clyde and East Coast.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
18	50, 53	..	2	·1
19	45, 66	..	2-5	·15-·3
20	46-83*	·3	2-8	·15-·3
21	66-102*	·1–·8	2-5	·1-·35
22	63-109*	·1–10	2-20	·1-·5
23	84-126	·2–18	2-25	·05-·6
24	103-154	·3–24	2-26	·1-·5, ·7, ·8
25	107-162	<1–28	2·5-30	·15-1·0
26	128-176	·5–36	3-31	·15-1·0
27	143-185	<1–27	5-25	·2-·9
28	152-194	·6–26	6-27	·3-·5, ·8, ·9
29	172-220	1–19	8-25	·35-·5, ·7, 1·0, 1·2
30	205, 214	1·7, 3	7-26	·3-·6
31	..	..	8-30	·4-·6
32	..	..	10-30	·4-·7
33	..	..	13-25	·5, ·6
..	..	..	.	..
35	216	..	16	..

* Had been in formaline.

AUGUST.

CLYDE.—Campbeltown, Arran Shore, 10th August 1907:—59 W. Spt., 21 to 27 cm.: eggs, ·15-·45 mm.: o, 2·5–8 mm.: t, 2-10 mm.: fat, great quantity. With one or two exceptions, which had empty stomachs, the herrings contained large quantities of food (copepods and schizopods).

CLYDE.—Between Lamlash and Ardrossan, 31st August 1906:—10 Imm., 20 to 23 cm.: eggs, ·15 mm.: o, 3 mm.: t, 2, 2·5 mm.: fat, large quantity; 38 Imm. dev., 20 to 24 cm.: eggs, 2-·6 mm.: o, 3-9 mm: t, 3-10 mm.: fat, large quantity; 36 W. Spr., 20 to 25 cm.: eggs, ·15-·55 mm.: o, 3-11 mm.: t, 5-16 mm.: fat, large quantity, some; 8 W. Spt., 22 to 25 cm.: eggs, ·1, ·3 mm.: o, 4-6 mm.: t, 12, 13 mm.: fat, much. Some of the stomachs had remains of food (crustacea).

Clyde.—Rothesay, Ascog Bay, 16th August 1907:—48 Imm., 17 to 20 cm.: eggs, ·1, ·15 mm.: o, 2-3 mm.: t, 1·5-2·5 mm.: fat, great quantity, some; 12 Imm. dev., 17 to 21 cm.: eggs, ·2-·35 mm: o, 2-4 mm.: t, 3 mm.: fat, great quantity, some. Most of the stomachs were empty: some contained food; one was large and filled with copepods.

Clyde.—Rothesay, 29th August 1907:—27 Imm., 14 to 20 cm.: eggs, ·1, ·15 mm.: o, 1·5-3 mm: t, 1-2 mm.: fat, great quantity; 3 Imm. dev., 18-20 cm.: eggs, ·2 mm.: o, 2·5, 3·5 mm.: t, 3·5 mm: fat, great quantity; 3 Spg. Spt. ♂, 18, 21 cm.: eggs, ·1, ·2 mm.: o, 2·5-6 mm.: fat, great quantity, none. The stomachs were in most cases empty; in a few there were remains of food.

Clyde.—Lower Loch Fyne, Laggan, 2nd August 1907:—54 W. Spt., 21 to 25 cm.: eggs, ·2-·3 mm.: o, 4-8 mm.: t, 2·5-5 mm.: fat, great quantity; 1 S. Spt. (recent) ♂, 24 cm.: t, 5 mm.: fat, none. The stomachs were empty.

Clyde.—Lower Loch Fyne, Inverneil Bay, 7th August 1909:—34 Imm., 17 to 20 cm.: o, 1–2·5 mm.: t, 1·25–3 mm.: they are oily: some food; 1 large Spent (not examined).

Clyde.—Lower Loch Fyne, Inverneil Bay, 11th August 1909:—(Taken with a smaller-meshed net than the sample of 7th August 1909) 110 Imm., 15 to 20 cm.: reproductive organs very small: fat, very much. There were remains of food in the stomachs.

Clyde.—Upper Loch Fyne, Newton, 8th August 1906:—40 W. Spr. (W. Spt.), 26 to 34 cm.: eggs, ·25-·7 mm.: o, 9-21 mm.: t, 12-24 mm.: fat, great quantity; 10 S. Spr. F. ♂, 31 to 33 cm.: t, 25-30 mm.: fat, great quantity. In one or two cases remains of crustacea were found in the stomach; in the majority the stomach was empty.

Clyde.—Upper Loch Fyne, Strachur, 3rd August 1909:—4 Imm. dev., 24 to 27 cm.: eggs, ·2 mm.: o, 4 mm.: t, 5·5, 6, 10 mm.: fat, great quantity; 5 S. Spr. F., 24 to 30 cm.: eggs, 1·0 mm.: fat, none; 3 W. Spr. dev. ♀, 23, 24 cm.: eggs, ·4, ·5, ·8 mm.: o, 10 mm.: fat, very much.

West Coast.—Stornoway, Loch Colobost, 16-18 fms., 13th August 1907:—16 Imm., 19 to 23 cm.: eggs, ·1, ·12 mm.: o, 2-3 mm.: t, 2-3 mm.: fat, great quantity; 8 W. Spt., 22 to 26 cm.: eggs, ·1, ·15, ·55, ·65 mm.: o, 6, 10 mm.: t, 9, 10 mm.: fat, large quantity, a little; 7 S. Spr., 23, 24 cm.: eggs, ·8 mm.: o, 10-14 mm.: t, 20, 22 mm.: fat, great quantity, a little: 4 W. Spr., 23, 24 cm.: eggs, ·5 mm.: o, 8 mm.: t, 15 mm.: fat, great quantity, none. A little food was found in several herrings; in most cases the stomach was empty.

West Coast.—Stornoway, 1½ to 2 miles off Loch Seaforth, 20-25 fms., 10th August 1906:—22 Imm. dev., 24 to 27 cm.: eggs, ·2, ·25 mm.: o, 3·5-6 mm.: t, 3-8 mm.: fat, large quantity; 9 W. Spt., 26 to 29 cm.: eggs, ·45, ·5 mm.: o, 9, 12 mm.: fat, great quantity: 20 W. Spr., 23 to 29 cm.: eggs, ·35-·5 mm.: o, 6-10 mm.: t, 4·5-19 mm.: fat, large quantity, none.

West Coast.—Stornoway, near Shiant Bank, 30th August 1906:—15 Imm., 20 to 25 cm.: eggs, ·05-·15 mm.: o, 2-5 mm.: t, 2, 2·5 mm.: fat, large quantity, a little; 11 Imm. dev., 22 to 25 cm.: eggs, ·2, ·35 mm.; o, 4, 5 mm.: t, 3, 4 mm.: fat, large quantity, some; 4 W. Spt., 24 to 27 cm.: eggs, ·15 mm.: o, 8 mm.: t, 3 mm.: fat, large quantity; 5 S. Spr., 23 to 26 mm.: eggs, ·85 mm.: o, 16 mm.: t, 19-27 mm.: fat, a little, practically none; 4 W. Spr., 22 to 29 cm.: eggs, ·35 mm.: o, 4 mm.: t, 16 mm.: fat, great quantity. Some herrings had food in their stomachs.

East Coast.—Eyemouth, 25 miles E.S.E. of, 2nd August 1906:—43 S. Spr. F., 23 to 27 cm.: eggs, 1·0, 1·1 mm.: o, 19-28 mm.: t, 20-30 mm.: fat, little or none; 9 S. Spr. dev., 22–27 cm.: eggs, ·8, ·9 mm.: o, 13-28 mm.: t, 17 mm.: fat, some, practically none; 1 W. Spt. ♀, 26 cm.: eggs, 45 mm.: o, 11 mm.: fat, large quantity; 1 W. Spr. ♀, 25 cm.: fat, large quantity. There were remains of food in some of the full herrings. Certain full herrings, however, had the stomach shrunk.

East Coast.—Eyemouth, 20-25 miles E. by S. of, 30th August 1906:—3 Imm., 23, 25 mm.: eggs, ·1 mm.: o, 3·5 mm.: t, 2·5, 3·5 mm.: fat, large quantity; 3 Imm. dev., 22, 24 cm.: eggs, ·75 mm.: o, 8 mm.: t, 6 mm.: fat, large quantity, some; 11 S. Spr. F., 23 to 28 cm.: eggs, 1·0 - 1·2 mm.: o, 15 - 30 mm.: t, 20 - 32 mm.: fat, large quantity, none; 17 S. Spr. dev., 22 to 24 cm.: eggs, ·7 - ·95 mm.: o, 9 - 16 mm.: t, 10 - 18 mm.: fat, large quantity, none; 3 Spt., 24, 25 cm.: eggs, ·1 mm.: o, 8 mm.: t, 18, 20 mm.: fat, none; 2 W. Spr., 22, 23 cm.: small reproductive organs: fat, large quantity. Most of the full herrings had been feeding.

East Coast.—Aberdeen, mouth of Harbour, 25th August 1908:—31 Imm., 6·8 - 8·3 cm.

East Coast.—Aberdeen, 13th August 1908:—21 S. Spr. F., 25 to 32 cm.

East Coast.—Peterhead, 62 miles S.E. of, 16th August 1906:—1 Imm. ♀, 23 cm.: eggs, ·15 mm.: o, 4 mm.: fat, great quantity; 1 Imm. dev. ♀, 25 cm.: eggs, 2 mm.: o, 5 mm.: fat, large quantity; 2 S. Spr. F., 27, 28 cm.: eggs, 1·0 mm.: o, 27 mm.: t, 29 mm.: fat, none; 6 S. Spr. dev., 23 to 26 cm.: eggs, ·55 - ·8 mm.: o, 8 - 15 mm.: t, 15 mm.: fat, large quantity; 24 S. Spt., eggs, ·1 - ·2 mm.: o, 4 - 15 mm.: t, 10 - 21 mm.: fat, none; 1 W. Spr., 22 cm.: eggs, ·35 mm.: o, 17 mm.: fat, large quantity. The stomachs were generally empty, but the fishes had been feeding.

East Coast.—8 miles S.E. of Fair Isle, 10th August 1906:—2 Imm. dev. ♂, 27, 28 mm.: t, 5, 7 mm.: fat, large quantity; 18 S. Spr. F., 28-30 cm.: eggs, 1·0, 1·1 mm.: o, 20 - 33 mm.: t, 25 - 31 mm.: fat, practically none; 4 S. Spr. dev. ♀, 28, 30 cm.: eggs, ·7 - ·9 mm.: o, 13 - 30 mm.: fat, large quantity, practically none; 2 Spg. Spt. ♀, 28 cm.: eggs, ·35 mm. (+ old eggs): o, 9 mm.: fat, large quantity; 3 S. Spt., 26, 30 cm.: fat, none; 12 W. Spr., 26 to 30 cm.: eggs, ·35 - ·5 mm.: o, 8 - 12 mm.: t, 5 - 11 mm.: fat, large quantity.

East Coast.—Lerwick, 50 - 70 miles East of Bressay, 13th August 1906:—26 S. Spr. F., 29 to 32 cm.: eggs, 1·0 - 1·2 mm.: o, 30 - 46 mm.: t, 30 - 37 mm.: fat, a little or none; 3 S. Spr. dev., 28, 30 cm.: eggs, ·9 mm.: o, 28, 32 mm.: t, 22 mm.: fat, a little or none. Some stomachs contained copepods, amphipods, and molluscs. Other stomachs were empty, thin-walled bags.

Summary.

Imm.—6 to 8, 14 to 25 cm.: eggs, ·05 - ·15 mm.: o, 1 - 3 mm.: t, 1 - 3 mm.: fat, large quantity, a little.

Imm. dev.—17 to 28 cm.: eggs, ·2 - ·75 mm.: o, 2·5 - 9 mm.: t, 3 - 10 mm.: fat, large quantity, some.

W. Spt.—21 to 32 cm.: eggs, ·1 - ·7 mm.. o, 2·5 - 21 mm.: t, 2 - 24 mm.: fat, great quantity.

Spr. Spt.—18 to 28 cm.: eggs, ·1 - ·35 mm.: o, 1·5 - 10 mm.: t, 2 - 10 mm.: fat, great quantity, none.

S. Spt. (recent).—22 to 30 cm.: eggs, ·1 - ·2 mm.: o, 7 - 17 mm.: t, 10 - 21 mm.: fat, a little or none.

S. Spr. Full.—22 to 33 cm.: eggs, ·9 - 1·2 mm.: o, 13 - 46 mm.: t, 20 - 37 mm.: fat, much, a little, none.

S. Spr. dev.—22 to 30 cm.: eggs, ·7, ·8 mm.: o, 8 - 16 mm.: t, 10 - 18 mm.: fat, some, much.

W. Spr.—20 to 34 cm.: eggs, ·1 - ·8 mm.: o, 3 - 16 mm.: t, 2 - 22 mm.: fat, great quantity, none.

Immature.—In some cases the small reproductive organs had a soft doughy or pasty condition; the blood vessels were of large diameter. In a fish 14 cm. in length, and in two larger fishes, the testis when teazed in water showed a distinct network structure. This seemed at first to be possibly a *post-mortem* change, but it is more probable that it is the first stage of ripening. Small reproductive organs 2 to 3 mm. broad in immature herrings, 19 to 23 cm. in length, were, in some cases, flat but solid with eggs; others were soft and pasty, filled with very small eggs.

Many of the herrings included under the heading "W. Spr." are no doubt ripening for the first time. Some have large eggs for comparatively small reproductive organs, *e.g.*, two herrings 22 cm. in length had ovaries 5 and 6 mm. broad, containing eggs ·5 mm. in diameter.

There is great difficulty in separating the immatures from the winter spents. In August it is possible that the great amount of fat laid up in the abdomen may crush the immature reproductive organ flat just as occurs in the winter spents. I do not think it becomes quite so thin as in the case of the spent.

Winter Spent.—As most of the winter spents have begun to ripen, the principal characters by which they may be detected have gone. They are therefore included with herrings that are ripening for the first time, under the denomination "Winter Spawners."

There are still some herrings showing the spent condition. The reproductive organs are small—in some cases flat and thin; in others they have become of a plump form, having commenced to ripen. It is a question if the spents which are in the furthest back condition at present may not be spring spents. In one fish the testis was a loose skin, and an open honeycomb structure was present. This condition was accompanied by a great quantity of fat. One fish that had eggs ·35 mm. in diameter had in the ovary some translucent nodules (? old eggs).

A considerable number of herrings showing flat skin-like reproductive organs, accompanied by great rolls of fat, was obtained at Laggan, Loch Fyne. In one female a series of crystalline bodies were observed in the oviduct; they may have been old eggs. I have seen no indication of old unspawned eggs being absorbed in the ovary. The testis showed the honeycomb structure, in some cases filled up.

Some of the herrings got at Campbeltown seemed to belong to the same class of herrings as those captured there last month—viz., winter spents. The eggs in some have commenced to store up yolk. Some ovaries were supplied with their complements of eggs; others were not.

Some of the winter spents have no doubt grown since they spawned. In an immature fish the ovary grows with a definite relation to the rest of the body, but when a fish has spawned the ovary is disorganised, and is not ready for some time to share in the growth which the fish acquires at once. The ovary has to undergo a process of preparation, during which the new crop of eggs is formed, and it meanwhile shrinks to a small size. It is not ready to take advantage of the generous food supply of the spring and early summer until after a certain period. There is no direct evidence to show how long this preparation stage lasts; it will not exceed six months. Meanwhile the fish grows in length, and thick rolls of fat accumulate on the gut and cœca. The reproductive organ is sometimes squeezed into a flat skin between the gut and the swim-bladder. The flattened condition of the reproductive organ may apparently also occur in an immature. We have the condition where a large herring has a very small reproductive organ. This fish, which one might be inclined to regard as immature, might, however, be a spent. It is not possible to rely merely on the small size of the ovary in diagnosing the class to which the herring belongs.

The amount of fat present in the winter spent is an indication of how long a time has elapsed since the fish spawned. Immediately after spawning the fish is thin, and, as a rule, shows no fat. Some recent spents do, however, have some abdominal fat.

Summer Spawners.—Although the majority of the herrings in the Clyde and at Stornoway are winter spawners, there is, however, a considerable proportion of summer spawners. Thus in the sample from Upper Loch Fyne several male herrings were practically ripe. Of the Stornoway herrings two males were full; one was apparently partly spent.

The full summer spawners got off Aberdeen were not actually spawning. The herring may not spawn immediately after the eggs become clear.

The full herrings from Shetland were oily, but not nearly so much so as the Loch Fyne herrings.

It has proved impossible to divide up the herrings sharply into summer and winter spawners. In localities where the winter spawners preponderate, a few herrings having eggs ·7 mm. in diameter would be looked upon as precocious winter spawners, whereas if they occurred in an East Coast sample they would be regarded as late summer spawners—viz., autumn spawners.

The extent to which the grading of one class into the other occurs on both the West and East Coasts is shown in the following Table, where the herrings are arranged in the order of the development of the ovaries, in so far as that is indicated by the diameter of the ova :—

[Table

Comparison between the Clyde, West Coast, and East Coast in respect to the Size of the Eggs.

Length.	Clyde (including Loch Fyne).*							West Coast (Stornoway).									East Coast.											
	·1	·2	·3	·4	·5	·6	·7	·05	·1	·2	·3	·4	·5	·6	·7	·8	·1	·2	·3	·4	·5	·6	·7	·8	·9	1·0	1·1	1·2
cm. 15	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
17	4	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18	7	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19	3	3	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	1	3	..	..	..	..	..	1	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21	1	3	1	..	..	..	..	2	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22	2	5	3	4	3	..	..	..	1	..	..	..	..	..	..	..	1	..	1	..	..	..	3	2	1	1	..	..
23	4	14	8	1	2	1	..	..	1	..	1	..	1	..	1	2	1	..	..	..	..	..	..	3	2	1	1	..
24	..	2	5	2	2	..	..	..	3	2	1	..	2	1	..	..	6	1	..	..	..	1	..	1	2	..	..	..
25	..	4	1	2	1	..	..	..	3	4	1	..	..	..	..	1	2	2	..	..	..	..	..	..	..	3	..	..
26	..	..	..	1	..	..	..	..	2	2	..	3	..	..	..	..	2	..	..	1	1	1	1	..	..	3	..	..
27	..	..	..	..	..	..	..	..	..	1	1	2	1	..	..	..	1	..	1	1	..	..	..	..	1	1	2	1
28	..	..	..	..	1	..	..	..	..	1	..	..	1	..	..	..	..	..	..	1	2	1	1	..	2	2	..	..
29	..	1	1	..	1	..	..	..	..	..	..	1	1	..	..	..	..	..	..	1	..	..	..	..	..	3	2	..
30	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..	1	6	2	..
31	..	..	..	..	1	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	1	..
32	..	..	..	..	2	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..

* The following have been omitted from the Clyde table, viz.:—Egg ·8 mm., fish 23 cm. long; egg 1·0 mm., fishes 27 and 28 cm. long.

The herrings from the Clyde and West Coast resemble one another. They were captured nearer the shore than those that came from the East Coast.

The Clyde herrings have here a range of eggs measuring from ·1–1·0 mm. in diameter; the West Coast herrings are similar, but they include no individual with eggs over ·8 mm. in diameter. The

East Coast specimens show a bigger range; they cover the range of the Clyde herrings, and extend beyond that to the ripe condition of the ova. There is a concentration towards the riper end of the scale, but herrings are represented with ova from ·1 mm. to 1·2 mm. in diameter. There is a mixture of winter and summer spawners. The overlapping individuals of each of these two groups together form an autumn spawning lot. The herrings of the Clyde, and the West and East Coasts, having eggs ·6 and ·7 mm. in diameter must be autumn spawners.

Food.—In the full herrings the stomach is sometimes small, and shrunken as if not functioning. Two herrings—a full and a developing summer spawner—had what appeared to be non-feeding stomachs. The latter had eggs ·85 mm. in diameter and no abdominal fat. It is therefore probable that the fish had only ceased from feeding for a short time. In other cases, although the posterior part of the stomach is squeezed flat between the two large reproductive organs, the anterior part, including the pylorus, contains food, and is sometimes full.

Herrings from Clyde, West Coast, and East Coast.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
14	..	..	1·5	..
15	34, 35	..	1, 2	·1
16	31 – 41	..	1 – 2	·1
17	34 – 47	..	1 – 2·5	·1 – ·2
18	41 – 57	..	2 – 4	·1 – ·2
19	44 – 62	..	1·5 – 3	·1 – ·3
20	57 – 91	..	1·5 – 5	·15, ·2
21	61 – 91	·1 – ·6	2 – 10	·15 – ·3
22	68 – 108	·1 – 14	2 – 13	·1 – ·5, ·7 – 1·0
23	86 – 130	·1 – 20	2 – 26	·1 – 1·1
24	73 – 147	·1 – 22	3 – 26	·1 – ·6, ·8, ·9
25	99 – 184	·2 – 29	2 – 26	·15 – ·4, ·8, 1·0
26	111 – 186	·3 – 31	3 – 26	·1 – ·25, ·4 – ·7, 1·0
27	129 – 218	·5 – 44	4 – 26	·25 – ·5, ·9 – 1·2
28	171 – 248	·5 – 46	5 – 26	·2 – ·7, ·9, 1·0
29	200 – 274	2·5 – 61	8 – 31	·25 – ·5, 1·0, 1·1
30	184 – 307	2·7 – 73	13 – 46	·15, ·5, ·7, ·9 – 1·1
31	240 – 334	4 – 85	12 – 36	·5 – ·7, 1·0, 1·1
32	268 – 341	11 – 62	15 – 36	·5 – ·7, ·9
33	306, 347	10, 31	16, 21	..
34	381	22	21	..

SEPTEMBER.

CLYDE.—Campbeltown, between Pladda and Brown Head, 22nd September 1906:—41 W. Spr., 23 to 27 cm.: eggs, ·25-6 mm.: o, 4·5-13 mm.: t, 12-21 mm.: fat, great quantity; 10 Aut. Spr. F. ♂, 25 to 28 c.m.: t, 20-25 mm.: fat, large quantity; 3 S. Spt., 23 to 26 cm.: eggs, ·15 mm.; o, 4, 15 mm.: t, 9 mm.: fat, large quantity. There was practically no food.

CLYDE.—3 miles east of Holy Isle, Arran, 18th September 1906:— 6 W. Spr., 23 to 25 cm.: eggs, ·5-·7 mm.: o, 10-13 mm.: t, 9-14 mm.

Clyde.—Rothesay, 5th September 1907 :—129 Imm., 14 to 19 cm. : eggs, ·1, ·12 mm. : o, 2, 2·5 mm. : t, 1, 2 mm. : fat, great quantity, practically none. The stomachs were empty.

Clyde.—Rothesay, north of Garroch Head, 14th September 1906 :—6 Imm., 20-23 cm. : eggs, ·15 mm. : o, 4 mm. : t, 2, 2·5 mm. : fat, large quantity; 31 Imm. dev., 20 to 25 cm. : eggs, ·2-·4 mm. ; o, 2·5-7 mm. : t, 3-6 mm. : fat, large quantity ; 46 W. Spr., 21 to 27 cm. : eggs, ·4-·6 mm.: o, 5-15 mm. : t, 5-16 mm. : fat, large quantity, some. Food was found in two fishes (W. Spr.) only. One stomach contained schizopods. The other stomachs were empty, thin-walled bags. In one herring, 24 cm. in length, the stomach was in an apparently resting condition. This fish had some abdominal fat.

Clyde.—Lower Loch Fyne, Ardrishaig, 2nd September 1909 :—67 Imm., 17 to 20 cm. : reproductive organs very small : fat, great quantity.

Clyde.—Lower Loch Fyne, Ardrishaig, 14th September 1909 :—281 Imm., 15 to 21 cm. : reproductive organs very small : fat, huge quantity; 1 W. Spr. dev., 24 cm. : ovary about half developed.

Clyde.—Upper Loch Fyne, off Strachur, 18th and 19th September 1905 :—12 Aut. Spr., 29 to 33 cm. : eggs, ·7, ·85 mm. : o, 20-30 mm. : t, 20-38 mm. : fat, small amount, very little. The stomach was empty in the majority of the specimens ; there was food (copepods) in one stomach. The herrings are not so fat as these got in July in this locality.

East Coast.—Aberdeen, 73 miles E. by S. of, 4th September 1907 :—10 Aut. Spr. F., 27 to 30 cm. : eggs, ·8 mm. : fat, none ; 3 S. Spt., 29 cm.: eggs, ·15 mm. : o, 7 mm. : t, 7, 10 mm. : fat, none. The spents had food in their stomachs, the full herrings had none. In one female the stomach was flattened.

East Coast.—Peterhead, 43 miles east of, 6th September 1906 :—12 Aut. Spr. F., 23 to 29 cm. : eggs, ·9, 1·0 mm. : o, 16, 18 mm. : t, 20, 21 mm. : fat, large quantity, none ; 30 S. Spt., 23 to 29 cm. : eggs, ·15, ·2 mm. : fat, none, much ; 3 W. Spr., 22 to 25 cm. : eggs, ·6 mm. ; o, 13, 15 mm. : t, 16 mm. : fat, large quantity. Most of the stomachs were empty. Food was, however, found in full herring, a spent, and a winter spawner.

East Coast.—15 miles S.E. of Fair Isle, 1st September 1906 :—15 S. Spr. F., 28 to 32 cm.: eggs, 1·1, 1·2 mm. : o, 31–35 mm.: t, 30-35 mm.: fat, none ; 12 S. Spt., 27 to 32 cm. : eggs, ·15 mm. : fat, none. One full had a big stomachful of crustacea ; others had remains of food or empty stomachs. The stomach of the spents was a big thin-walled bag, in most cases empty. One spent had a "blue-bag" stomach, containing copepods and remains of fish.

East Coast.—Lerwick, 2 miles S.E. of, 6th September 1906 :—17 S. Spr. F., 26-31 cm. : eggs, 1·1, 1·2 mm. : t, 26-40 mm. : fat, none, some ; 5 Aut. Spr., 25 to 31 cm. ; eggs, ·8-1·0 mm. : o, 15-38 mm. : fat, some, none ; 14 S. Spt., 25 to 28 cm. : eggs, ·1-·25 mm. : fat, much, none ; 2 W. Spr., 26, 28 cm. : eggs, ·5 mm. : o, 10 mm. : t, 15 mm. : fat, large quantity. The full herrings, S. Spr. and Aut. Spr., had in some cases food in the stomach ; in one case the stomach was compressed. The Spents and W. Spr. had also food, a large quantity in two cases. In the W. Spr., the large stomach full of crustacea was purple in colour.

East Coast.—Lerwick, 20 miles E.S.E. 25th September 1906 :—2 Aut. Spr., 27 cm. : eggs, 1·0 mm. : o, 16 mm. : t, 25 mm. : fat, practically none ; 33 S. Spt., 26 to 30 cm. : eggs, ·1-·2, ·3, ·5 mm. : o, flabby : t, flabby : fat, practically none ; 2 W. Spr., 28, 29 cm. : eggs, ·6 mm. : o, 9, 13 mm. : fat, large quantity, practically none. One full had crustacea in the stomach ; in the other the stomach was empty, apparently non-feeding. The spents, with one exception, and the winter spawners had empty stomachs.

Summary.

IMM.—14 to 23 cm. : eggs, ·1-·15 mm. : o, 2-4 mm. : t, 1-2·5 mm. : fat, great quantity, practically none.

IMM. DEV.—20 to 25 cm. : eggs, ·2-·4 mm. : o, 2·5-7 mm. : t, 3-6 mm. : fat, large quantity.

S. SPR. F.—26 to 32 cm. : eggs, 1·1, 1·2 mm. : o, 31-36 mm. : t, 26-40 mm. : fat, none, some.

AUT. SPR.—23 to 33 cm.: eggs, ·7-1·0 mm.: o, 15-38 mm.: t, 20-38 mm.: fat, large quantity, a little.

W. SPR.—20 to 30 cm.; eggs, ·25-·7 mm. ; o, 4-15 mm. ; t, 5-21 mm. : fat, great quantity, some.

S. SPT.—23 to 32 cm. : eggs, ·1-·25, ·3, ·5 mm. : o, 4-15 mm. : t, 7-10 mm. : fat, none, large quantity.

Winter Spawners.—The winter spawners no doubt consisted of immature herrings which have begun to ripen, and of winter spents, developing also. Some of the Campbeltown specimens had loose oviducts and large blood vessels.

Summer Spawners.—One difficulty is to estimate how long a fish requires for its reproductory organ to ripen. I think that this period may be comparatively short. The summer spawners are about fully developed. In a full female, 30 cm. long, there were what appeared to be remains of old ripe eggs in the ovary.

Autumn Spawners.—The autumn spawners are a little behind the summer spawners, and in front of the winter spawners. The sample of large herrings got at Strachur belonged to this division. The herrings were, with one exception, not at all oily. One, a male, 26 cm. in length, was somewhat oily in respect to its abdominal contents.

Summer Spents.—Recent spents had flabby reproductive organs. Old unspawned eggs were found in some ovaries, *e.g.*, one from Campbeltown, and several from the East Coast. One Campbeltown spent had the small flattened dry ovary, 4mm. broad. The eggs in the spents were very small. The stroma generally had a dirty appearance, and old follicles could be made out between the new eggs. Two spents which have been included among the summer spents had their largest eggs measuring ·3 and ·5 mm. respectively. Both may have been spring spents.

The summer spent does not appear to be as emaciated as the winter spent.

[TABLE.

Herrings from Clyde and East Coast.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
15	28–32	..	2	·1
16	26–41	..	2, 2·5	·12
17	32–42	..	1, 2	..
18	37–51	..	2	..
19	53	..	..	..
20	74, 75	·2, ·3	2·5, 3	·2
21	74–84	·2–1·2	2–6	·2–·4
22	78–102	·2–6·6	2·5–16	·15, ·2, ·4
23	91–122	·2–5·7	2·5–16	·15–·6
24	93–137	·2–5 7	3–16	·15–·25, ·4–·6
25	96–162	·5–15	3–21	·15–·9
26	107–172	·8–38	2·5–20	·1–·5, ·9, 1·2
27	119–186	·8–34	5–26	·15, ·2, ·5, ·6, 1·0
28	125–202	·8–51	7–20	·1–·2, ·5, ·9–1·2
29	142–257	1·1–69	9–36	·1, ·15, ·8, 1·0–1·2
30	152–307	1·2–74	13, 31	·15, ·3, ·5
31	223–311	17–84	20–36	·7, 1·0
32	176–356	2·2–44	21, 26	·8
33	345, 352	32, 36	21, 26	·8

OCTOBER.

CLYDE.—5 miles off Davaar I., 16th October 1907 :—26 Aut. Spr., 23 to 32 cm. : eggs, ·9 mm. : o, 20, 26 cm. : t, 20-28 mm. : fat, large quantity, a little ; 1 S. Spt. ♂, 27 cm. : fat, none ; 39 W. Spr., 24 to 29 cm. : eggs, ·4-·8 mm. : o, 8-20 mm. : t, 10-19 mm. : fat, large quantity, a little. Some of the herrings, both autumn and winter spawners, had copepods in their stomachs ; others of both lots had empty stomachs. The summer spents had food in their stomachs.

CLYDE.—Lower Loch Fyne, north of Ardlamont, 2nd October, 1906 :—14 Imm., 19 to 24 cm. : eggs, ·15 mm. : o, 2, 3 mm. : t, 2 mm. : fat, large quantity, some ; 35 Imm. dev., 19 to 24 cm. : eggs, ·2–·4, ·7 mm. : o, 3-10 mm. : t, 3-15 mm. : fat, large quantity, a little ; 47 W. Spr., 20 to 26 cm. : eggs, ·35-·75 mm. : o, 5-18 mm. : t, 10-17 mm. : fat, large quantity, practically none : 2 Aut. Spr. ♂, 24, 25 cm. : t, 20, 23 cm. : fat, large quantity. Two herrings had some food in the stomach ; the rest had empty stomachs.

CLYDE.—Upper Loch Fyne, near Inveraray, 8th October, 1906 :—19 Aut. Spr. F., 30 to 32 cm. : eggs, 1·0, 1·35 mm. ; o, 26, 27 mm. ; t, 24-33 mm. : fat, some, practically none ; 23 W. Spr., 28 to 32 cm. : eggs, ·4-·9 mm. : o, 15-26 mm. : t, 20, 24 mm. ; fat, large quantity, none. All the stomachs were empty. A white paste containing remains of crustacea was found in the pylorus in several cases. One stomach was in an apparently resting condition ; it did not seem to have contained food for some little time.

WEST COAST.—35 miles N.W. of Inishtrahull Light, Ireland, landed at Aberdeen by steam trawler, 29th October, 1907 :—8 Aut. Spr. F, 30 to 35 cm. : eggs, 1·0 mm. : o, 25, 29 mm. : t, 30, 35 mm. : fat, a little. In the stomach of one there were a few copepods. The others had empty stomachs.

West Coast.—Off Ireland, 31st October, 1907 :—(These herrings were in formaline for some time before they were examined.) 7 Aut. Spr. F., 30 to 33 cm. : eggs, ·9 mm. : o, 28, 30 mm. : t, 27, 30 mm. : fat, some, none ; 5 W. Spr., 29 to 33 cm. ; eggs, ·7, ·8 mm. : o, 20-23 mm. : fat, large quantity, some. All except one had empty stomachs.

East Coast.—Moray Firth, October 1904 ;—(These herrings had been in alcohol). 5 Imm., 10, 12 cm. : fat, a little ; 1 W. Spr. (? Imm. dev.) ♂, 20 cm. : t, 3 mm. : fat, a little.

Summary.

Imm.—19 to 24 cm. ; eggs, ·15 mm. : o, 2, 3 mm. ; t, 2 mm. ; fat, large quantity, some.

Imm. Dev.—19 to 24 cm. ; eggs, ·2-4, ·7 mm. : o, 3-10 mm. : t, 3-15 mm. ; fat, large quantity, a little.

W. Spr.—20 to 33 cm. : eggs, ·35 - ·9 mm. : o, 5 - 26 mm. : t, 10 - 24 mm. : fat, large quantity, none.

Aut. Spr.—23 to 33 cm. ; eggs, 1·0, 1·35 mm. : 0, 20-30 mm. ; t, 20-35 mm. : fat, large quantity, none.

S. Spt. ♂.—27 cm. : fat, none.

Taking the herrings all together, we have a complete series of development of the reproductive organs from the immature to the nearly ripe.

The winter spawners consist of last winter's spents and also of herrings that are preparing to spawn for the first time The autumn spawners act as the advance-guard of the winter spawners, while the immature developing herrings bring up the rear. The immature herrings having eggs ·15 mm. might possibly be included with the immature developing. Will they spawn during the winter ?

One male 25 cm. long appeared to have been a winter spent. The testis was 10 mm. broad. Its tissue had a distinct sponge-like honeycomb structure. On teazing a portion in water a white powdery material was washed out. The testis was filling up and had a somewhat solid consistency. There was a large quantity of fat present.

The herrings from Ardlamont, both immature and winter spawners, were firm in the abdomen ; they had a large quantity of abdominal fat.

The large full herrings got off the north coast of Ireland are similar to the large herrings of Loch Fyne.

Herrings from Clyde and North of Ireland.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
19	50–61	·2, ·3	3–5	·25
20	55–72	·1, ·2	2–5	·2, ·25
21	62–88	·1–2·5	2–12	·15–·5
22	69–102	·3–7·5	4–17	·2–·6
23	86–117	·2–11	4–20	·25–·7
24	99–137	1–11	5–20	·4–·7
25	116–146	1–11	10–23	·4–·7
26	120–170	1–18	8–25	·4–·8
27	107–186	6–23	12–25	·6–·9
28	183–227	11–27	20–25	·8
29	189, 198	8, 17	16–28	·6, ·7
30	248–321	8–43	15–35	·5–·9
31	274–334	14–39	15–33	·5–·9
32	240–331	9–47	16–33	·4, ·6, ·9, 1·0, 1·35
33	339, 377	48, 53	20–35	·8, 1·0

Among herrings of similar quality a longer herring does not always mean a heavier herring.

The breadth of the ovary is sometimes increased by the compression exerted by the other abdominal organs, irrespective of increase due to growth.

NOVEMBER.

CLYDE.—Campbeltown, between Pladda and Sanda, 6th November 1907 :—25 Aut. Spr. F. ♂., 23 to 28 cm. : t, 21–26 mm. : fat, some, none ; 35 W. Spr., 23 to 29 cm. : eggs, ·6–·9 mm. : o, 13–24 mm. : t, 11–17 mm. : fat, a large quantity, a little ; 1 Spent ♂, 25 cm. : t, 5 mm. : fat, large quantity. The stomachs were empty.

CLYDE.—Campbeltown, 3 miles S.E. of Davaar I., 19th November 1907 :—17 Aut. Spr. F., 25 to 29 cm. : eggs, 1·0 mm. : o, 20–24 mm. : t, 23–30 mm. : fat, none, some ; 33 W. Spr., 23 to 29 cm. : eggs, ·6–·9 mm. : o, 11–25 mm. : t, 15–20 mm. : fat, none, a large quantity. They all had very large stomachs full of copepods, and in one case of schizopods also.

CLYDE.—Campbeltown, 8 miles S.E. of Davaar I., 30th November 1908 :—15 Aut. Spr. F., 25 to 28 cm. : eggs, 1·0 mm. : o, 21, 25 mm. : t, 22–27 mm. : fat, a little, none ; 35 W. Spr., 22 to 28 cm. : eggs, ·4–·9 mm. : o, 6–28 mm. : t, 10–18 mm. : fat, some, large quantity, none ; 10 S. Spt., 22 to 26 cm. : eggs, ·12, ·15, ·25 mm. : o, 3–6 mm. : t, 2, 3·5 mm. : fat, a large quantity, some. In all but seven cases the amount of food was noted. They had all big stomachs full of copepods.

CLYDE.—Kilbrennan Sound, Carradale, 10th November 1908 :—11 Aut. Spr. F. ♂, 26 to 29 cm. : t, 22–37 mm. : fat, a large quantity, some ; 47 W. Spr., 24 to 29 cm. : eggs, ·35–·8 mm : o, 10-21 mm. : t, 15-20 mm. : fat, a large quantity, a little ; 1 S. Spt. ♀, 25 cm. ; eggs, ·25 mm. : o, 5·5 mm. : fat, large quantity. Some had empty stomachs, while others had copepods in the stomach.

CLYDE.—Off Largs, 19th November 1907 :—57 Imm., 14 to 21 cm. : eggs, ·05-·17 mm. : o, 1-3·5 mm. ; t, ·5-2·5 mm. ; fat, a large quantity, a little ; 1 Imm. dev. ♀, 19 cm. ; eggs, ·25 mm. : o, 2·5 mm. : fat, large quantity ; 34 W. Spr., 17 to 24 cm. : eggs, ·3 to ·8 mm. ; o, 4-15 mm. : t, 8-19 mm. : fat, a large quantity, a little ; 2 Aut. Spr. F. ♂, 24, 25 cm. : t, 25, 27 mm. ; fat, a little ; 2 S. Spt. ♂, 21 cm. : t, 4, 6 mm. : fat, large quantity. Some stomachs contained food ; others were empty. I regard all the W. Spr. 17-25 cm. as immature developing, that is, preparing to spawn for the first time.

CLYDE.—Upper Loch Fyne, Minard, 24th November 1905 :—36 Aut. Spr. F., 27 to 32 cm. : eggs, 1·0, 1·2 mm. ; o, 23-31 mm. : t, 27-40 mm. ; fat, not noted ; 2 W. Spr. ♂, 24, 27 cm. : fat, not noted. The stomach was a thin-walled bag. In some cases the alimentary canal retained remains of crustacea, but in most cases it was empty.

EAST COAST.—Moray Firth, 23rd November 1908 :—5 Imm., 12 to 14 cm. : fat, great quantity.

EAST COAST.—Yarmouth, 16th November 1908 :—26 Aut. Spr., 22 to 27 cm. : eggs, 1·0, 1·9 mm. ; o, 16 to 27 mm. : t, 22-30 mm. : fat, none, a little ; 18 W. Spr., 22 to 29 cm. : eggs, ·8, ·9 mm. : o, 15-25 mm. ; t, 17-20 mm. ; fat, none, a trace. The stomach was empty, and in five cases dry. In one specimen the gut also was dry. The herrings resemble those of Loch Fyne.

Summary (*Clyde and East Coast*).

IMM.—14 to 21 cm. : eggs, ·05-·17 mm. : o, 1-3·5 mm. : t, ·5-2·5 mm. fat, a large quantity, a little.

Imm. dev.—19 cm. : eggs, ·25 mm. : o, 2·5 mm. : fat, large quantity.

W. Spr.—17 to 31 cm. : eggs, ·3-·9 mm. : o, 4-28 mm. : t 8-20 mm. ; fat, a large quantity, none.

Aut. Spr.—23 to 32 cm. ; eggs, 1·0-1·2 mm. : o, 16-31 mm. : t, 21-40 mm. : fat, some, none.

S. Spt.—21 to 26 cm. : eggs, ·12, ·15, ·25 mm. : o, 3-6 mm. : t, 2-6 mm. : fat, large quantity, some.

The herrings obtained in this month show two well-marked divisions, viz., (1) Immature herrings from 12-21 cm. in length; and (2) winter spawners, 17 to 32 cm. in length. The winter spawners show a long range of development from eggs ·3 mm. in diameter to those 1·2 mm. in diameter. The herrings having eggs 1·0 mm. and over in diameter, and those having testes 20 mm. and over in breadth, have been detached from the winter spawners and labelled autumn spawners, as they will probably spawn soon. At the lower end of the winter spawning group there are the herrings that are ripening for the first time ; they have just left the immature group. The immature developing herrings are represented by one fish 19 cm. in length, having eggs ·25 mm. in diameter. The immatures had eggs up to ·17 mm., which may indicate the beginning of ripening.

The group of Winter Spawning herrings got at Largs is probably wholly composed of fishes that are ripening for the first time. The upper limit of this lot is 24 cm. The sample gives 17 to 24 cm. as the range in November of the first spawning group of the winter spawners. These limits probably do not give the full range in size. It is noticeable how small the ovaries are in this group of developing winter spawners, in comparison with the size of the eggs. In the following list is given, opposite the length of the fish, the breadth of the ovary in mm., and after each breadth, within brackets, is added the size of the yolked eggs in mm. :—

Length of Fish.	
cm.	
17	5 (·4)
19	4 (·3), 6 (·4), 8 (·5)
20	5 (·4), 6 (·4), 8 (·4), 8 (·5), 10 (·7)
21	5 (·4), 6 (·5), 8 (·4), 9 (·6), 10 (·8)
22	8 (·5), 9 (·6), 12 (·7)
23	10 (·6), 10 (·7)
24	15 (·8)

Autumn and Winter Spawners.—There was a considerable proportion of autumn spawners both among the Clyde and Loch Fyne fishes. The herrings got at Yarmouth during this month were autumn and winter spawners well advanced in the development of the reproductive organs.

The abdominal fat of many of the winter spawners is being rapidly used up.

A developing winter spawner had a testis 16 mm. wide. A white powder was washed out, leaving a spongy tissue. The skin of the testis was thin.

Summer Spents.—A female 26 cm. long had a soft, skin-like ovary, 6 mm. in width. The stroma was soft, ductile. There was some spacing between the eggs, the largest of which measured ·12 mm. in diameter. Two male spents, 22 and 23 cm. long respectively, had wide vasa deferentia and wide blood vessels. On washing a piece of the testis, which was 2 mm. wide, in water, a shreddy honeycomb structure was observed. Both the female and the males had a large quantity of fat. A male 25 cm. long had a testis 5 mm. broad. The testis was flat. The skin was fairly thick, the honeycomb marking being distinct upon it. A piece of the tissue on washing exhibited the sponge structure. There was much abdominal fat present.

Herrings from the Clyde.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
14	24	..	..	..
15	25, 40	..	2	·15
16	30–38	..	1·5–3	·07, 1
17	34–53	<1	1–5	·05–·17, ·4
18	43–60	1	1–8	·07, ·1
19	53–68	Nearly 1	1·5–8	·07–·5
20	60–77	1–3	2–10	·15, ·4, ·5, ·7
21	73–92	<1–5	2·5–13	·4–·8
22	76–108	1–5	2–10	·15, ·5–·7
23	98–114	2–17	2–25	·15, ·6, ·7
24	99–139	7–20	5·5–28	·25, ·4, ·5, ·7, ·8
25	105–164	7–25	5–30	·25, ·4, ·6–·9
26	129–174	6–26	6–28	·12, ·3–·9
27	143–205	7–30	9–30	·4–1·0
28	183–222	13–36	13–36	·7–1·0
29	177–274	15–48	16–31	·5, ·7, ·9, 1·0
30	245–298	29–52	26–36	1·0–1·2
31	266–312	37–56	21–36	1·0, 1·1
32	324, 330	..	..	1·1

The Loch Fyne herrings were heavier than some of those from the Clyde, but there was not much material for the elucidation of this point.

DECEMBER.

CLYDE.—Campbeltown, 5 miles S.E. of Davaar I., 24th December 1907:—5 Imm., 20 to 23 cm.: eggs, ·15, ·17 mm.: o, 2·5–4 mm.: t, 2·5 mm.: fat, large quantity; 61 W. Spr., 21 to 29 cm.: eggs, ·7, 1·1 mm.: o, 10–26 mm.: t, 7-30 mm.: fat, some, none: some of the W. Spr. were full herrings; 1 S. Spt. ♂, 25 cm. Most of the herrings had large stomachs full of copepods and schizopods.

CLYDE.—2 miles off Girvan, 20th December 1906:—55 W. Spr., 22 to 27 cm.: eggs, ·4–1·1 mm.: o, 6–23 mm.: t, 6–23 mm.: fat, large quantity, none: some of the W. Spr. are full herrings; 2 Spg. Spr., 22 cm.: eggs, ·25 mm.: o, 4 mm.: t, 5 mm.: fat, some. Copepods were found in the stomachs of a large number; a few had empty stomachs.

CLYDE.—Rothesay, Loch Striven, 19th December 1906:—150 Imm., 13–22 cm.: eggs, ·1, ·15 mm.: o, 2 and 3 mm.: t, 1·5–3 mm.: fat, great quantity, some; 15 W. Spr., 18 to 22 cm.: eggs, ·6–1·0 mm.: o, 5–13 mm.: t, 7–14 mm.: fat, large quantity, a little; 11 Spg. Spr., 17 to 21 cm.: eggs, ·2–·3 mm.: o, 2–4 mm.: t, 3·5–6 mm.: fat, large quantity. In most of the herrings the stomach was large and full of copepods; one or two herrings had empty stomachs.

Clyde.—Gareloch, 18th December 1906:—1 Imm. ♂, 23 cm.: t, 3 mm.: fat, large quantity; 47 W. Spr., 19 to 26 cm.: eggs, ·4–1·0 mm.: o, 4–18 mm.: t, 9–26 mm.: fat, large quantity, none. The stomachs were empty.

Clyde.—Upper Loch Fyne, 12th December 1905:—30 W. Spr., 26 to 33 cm.; eggs, ·8–1·2 mm.: o, 20–34 mm.: t, 28–37 mm.: fat, not noted. The stomach was flaccid in some cases, shrunken in others. As a rule it was empty. Two stomachs had remains of food, and there was in the pylorus and gut of most of the specimens a red matter which indicated they had been feeding lately (probably on copepods).

East Coast.—Firth of Tay, 8th December 1906:—403 Imm., 5 to 15 cm.

East Coast.—Firth of Forth, 20th December 1907:—18 Imm., 18 to 20 cm.: eggs, ·17 mm.: o, 2·5, 3 mm.: t, 1·5–2·5 mm.: fat, large quantity; 4 Imm. dev. ♀, 19 to 21 cm.: eggs, ·2 mm.: o, 2–3 mm.: fat, great quantity; 1 W. Spr. ♀, 20 cm.: eggs, ·5 mm.: o, 9 mm.: fat, a little. One stomach was full of food, apparently schizopods; the other stomachs were empty.

Swedish Herrings landed at Leith, 31st December 1907:—9 Imm., 15 to 19 cm.: eggs, ·15, ·2 mm.: o, 2, 3·5 mm.: t, 1, 1·5 mm.: fat, a large quantity, a little; 1 W. Spr. ♀, 26 cm.: eggs, ·5 mm.: o, 9 mm.: fat, large quantity; 1 S. Spt. ♀, 26 cm.: eggs, ·2 mm.: o, 8 mm.: fat, large quantity. One stomach had remains of crustacea; the other stomachs were empty.

Summary (*Clyde and East Coast*).

Imm.—5 to 23 cm.: eggs, ·15, ·17 mm.: o, 2–3 mm.: t, 1·5–3 mm.; fat, large quantity, some.

Imm. dev. ♀.—19 to 21 cm.: eggs, ·2 mm.: o, 2–3 mm.: fat, great quantity.

Spg. Sprs.—17 to 22 cm.: eggs, ·2, ·3 mm.: o, 2–4 mm.: t, 3·5–6 mm.: fat, large quantity, some.

W. Sprs.—18 to 31 cm.: eggs, ·4–1·2 mm.: o, 4–34 mm.: t, 6–37 mm.: fat, large quantity, none.

S. Spt. ♂.—25 cm.: t, skin-like.

The immature herrings from the Clyde, 13 to 21 cm. in length, had a large quantity of abdominal fat. They had nevertheless been feeding largely, for the stomachs were full of copepods. This indicates that the store of fat in the abdomen is not a provision for the growth of the body, but is a reserve for the formation of the roe and milt. The spring spawners (17–22 cm. long) have probably just left the immature group. They will probably grow before they spawn.

[Table.

Herrings from the Clyde.

Length.	Range of Weight.	Weight of Reproductive Organs.	Breadth of Reproductive Organs.	Diameter of Eggs.
cm.	*grammes.*	*grammes.*	*mm.*	*mm.*
14	20, 23	..	..	..
15	23, 24	..	2	·15
16	29	..	3	..
17	31–42	·1	2–3·5	·15–·25
18	36–50	·1, ·12	2–7	·2, ·25, ·7
19	42–62	·1–5	1·5–13	·5, ·6
20	54–76	·1–4·2	2·5–12	·15, ·3, ·4, ·7, ·9
21	65–90	1–12	3–16	·15–·25, ·4–·9
22	69–104	·2–14	3–21	·15, ·25, ·5, ·7, ·8, 1·0, 1·1
23	85–116	·1–13	3–21	·17, ·4–·6, ·8–1·0
24	102—135	3–21	10–21	·7–1·0
25	88–153	2·5–24	9–26	·6–1·1
26	123–183	5–31	12–26	·7, ·8, 1·0
27	152–179	7–30	13–26	·7, 1·0
28	203	27	21	·9
29	190–232	21–43	21, 26	·8, ·9, 1·2
30	233–298	33–56	26, 31	1·0
31	245–308	43–56	26, 31	1·0–1·2
32	282–330	37–62	21–31	·8, 1·0, 1·2
33	314	56	31	1·2

THE WEIGHT OF THE HERRING.

All the herrings were not weighed. The Clyde herrings that were weighed numbered 2900. The average weight at each centimetre of length of these fishes is shown in the appended Tables.

A considerable number of herrings from the West Coast and East Coast have also been weighed. The weights of these are included in the range of weight given in the table for each month.

In the case of the Clyde specimens, the Winter Spents are separated from the other herrings (viz., Immature, Summer Spawning, and Full Winter Herrings) for the months February to June.

The herrings all over are heaviest in the Clyde from July onwards to the end of the year. In January they are losing weight, but they still show a good average. They lose more in February and March. During these two months a large proportion of the herrings in the samples from the Clyde were Winter Spents. Herrings which have spawned recently are in poor condition, and weigh much less than the other herrings. The Spents, however, rapidly improve in quality during the spring and summer. In June they showed a higher average weight than the other herrings accompanying them.

The weights of certain East Coast herrings, viz., Summer Full Herrings and Summer Spents, are added for the months of August and September for the purpose of comparison with the herrings of the Clyde. The Summer Spents do not appear to be so emaciated as some of the Winter Spents of the Clyde. Three spents in April, measuring 28–30 cm., were obtained at Campbeltown. They weighed 67–78 grammes. The herrings of this sample were very thin fishes. One Winter Spent 24 cm. long in January weighed 75 grammes.

The very heavy large herrings, measuring 29–34 cm., recorded in the Tables for August to December were from Upper Loch Fyne.

Average Weight (grammes) of Herrings at Each Size for each Month from the Clyde.

Length. cm.	JANUARY.	FEBRUARY.		MARCH.		APRIL.	
	All Herrings except 1 Winter Spent.	All except Winter Spents.	Winter Spents.	All except Winter Spents.	Winter Spents.	All except Winter Spents.	Winter Spents.
14	..	..	..	..	..	16	..
15	..	23	..	..	..	17	..
16	..	27	..	..	..	19	..
17	..	32	..	..	..	25	..
18	..	39	..	..	..	28	..
19	..	45	..	..	*44	36	*29
20	62	53	..	..	*56	39	43
21	72	65	..	..	60	45	46
22	83	68	..	73	68	54	57
23	97	87	79	86	83	62	67
24	104	107	*101	101	92	..	77
25	116	116	*104	112	103	..	96
26	135	129	118	118	114	..	90
27	164	151	..	142	129	..	100
28	192	170	147	172	137	..	*67
29	204	190	..	178	..	..	*88
30	235	212	..	..	..	..	*78
31	254	262	..	..	..	..	..
32	282	..	..	..	..	..	..
Total number of herrings weighed	181	176	11	44	180	232	219

*One specimen only.

[TABLE.

Average Weight (grammes) of Herrings from the Clyde.

Length. cm.	MAY.		JUNE.		JULY.	AUGUST.	SEPT.
	All except Winter Spents.	Winter Spents.	All except Winter Spents.	Winter Spents.	All Herrings.	All Herrings.	All Herrings.
15	20	..	*27	..	..	34	30
16	25	..	31	..	..	34	33
17	35	..	33	..	..	38	37
18	39	..	41	..	51	49	43
19	45	..	54	..	56	55	*53
20	52	..	60	..	58	67	*74
21	60	58	68	70	77	77	80
22	65	63	75	84	87	89	90
23	68	74	83	88	105	101	105
24	..	90	96	102	116	114	113
25	..	99	101	119	131	131	130
26	..	106	91	134	153	*142	157
27	..	..	..	*163	163	*158	183
28	..	..	..	*163	174	248	..
29	..	..	..	..	..	246	*241
30	..	..	..	..	..	289	289
31	..	..	..	..	..	300	310
32	..	..	..	..	..	324	314
33	..	..	..	..	..	326	348
34	..	..	..	..	..	*381	..
35	*†379	*†295	..	..	..	..	..
Total number of herrings weighed	173	94	240	149	138	262	117

* One specimen. † Had been in formalin solution.

Average Weight (grammes) of Herrings.

Length.	CLYDE.			EAST COAST.			
	OCT.	NOV.	DEC.	AUGUST.		SEPTEMBER.	
cm.	All Herrings.	All Herrings.	All Herrings.	Herrings other than S. Spt.	S. Spt.	Herrings other than S. Spt.	S. Spt.
14	..	*24	21	..	..	..	..
15	..	32	23	..	..	..	..
16	..	33	*29	..	..	..	..
17	..	42	35	..	..	..	..
18	..	48	42	..	..	..	..
19	56	60	50	..	..	..	..
20	62	68	64	..	..	..	..
21	72	81	75	..	..	..	..
22	86	90	86	90	..	*97	..
23	101	104	98	104	..	*115	94
24	116	121	118	121	111	*126	105
25	131	133	132	133	113	131	118
26	150	149	152	148	123	159	122
27	165	173	165	175	135	167	132
28	204	197	*203	198	..	177	143
29	193	228	212	221	..	205	156
30	279	271	254	247	*184	220	176
31	293	295	276	265	..	254	..
32	300	327	306	271	..	*266	*176
33	..	..	*314	..	..	..	..
Total number of herrings weighed	201	238	245	150	25	58	86

* One specimen.

The herrings got in Upper Loch Fyne in December are rather less in weight than those got there in November; but there is not much material upon which to found.

In some cases of fishes of the same length, the heavier herring sometimes had a larger reproductive organ; in other cases it had a smaller organ. Milroy gives the weights of a number of herrings from Loch Fyne during the period May to December. The weights of the reproductive organs are also shown. The paper was mainly concerned with the chemical composition of the herrings in different seasons. Milroy says:—"In the summer fish from Loch Fyne, when the ovaries are in an immature condition the fat percentage was usually about that which is given as the average for the herring. The fat percentage of the herring muscles therefore continues rising during the three months probably of August, September, and October. It begins to fall slightly in November, markedly in December, most markedly during spawning, and continues at a low level until the fish begins to feed again." [The fish probably begins to feed immediately after spawning]. "The fat percentage of the ovaries is highest in Loch Fyne herrings between the months of July and September."

The weight of a number of herrings measuring from 2 to 32 cm. in length is given by Fulton in his paper, "On the Rate of Growth of Fishes."

The Stage of Development of the Reproductive Organs.

During the examination of the samples it was noted that the male and female herrings are similar in size. If, for example, a sample of herrings contains females having very small reproductive organs, it is extremely probable that with them there will be males of a similar length showing testes in a corresponding stage of development. A similar relation is found among herrings having reproductive organs in other conditions. It is thus possible to analyse a sample of fishes by the condition of the females, since it can be inferred that there will be a series of male fishes corresponding to them. It is easier to gauge the stage of development of the ovary than that of the testis, because the diameter of the egg gives a ready indication of the nearness or otherwise of the spawning period.

The reproductive organs have been classified in three ways:—(1) By weight, (2) by their greatest breadth, and (3) in the case of the ovary by the diameter of the eggs. So far as the first two methods are concerned, the data only give a relative indication of the stage of development, since along with these factors it is necessary to consider the size of the fish. Thus a small fish may have its reproductive organ practically ripe, when the organ may be very small in comparison to the ripe ovary of a larger fish. Similarly, the weight of the pair of ovaries or testes cannot be treated absolutely. The breadth of the organ is affected by the amount of compression to which it is subjected by the other abdominal organs. In the tables for each month the breadth of the ovary and testis have been taken together and arranged at each centimetre of length of the fish. The weights of the ovaries and testes have also been combined. Alongside are given the sizes of the eggs which were measured. In this way a picture is afforded of conditions of development which occur in herrings of definite lengths. The picture is that afforded by the present investigation, and does not exclude other conditions which were not observed, but which may very well occur.

A herring which has a large reproductive organ is known as a "Full" herring. The full herring is recognised before dissection, since the large roe or milt fills up the abdomen and gives it a firm, resistent feel. In contrast to this condition, a herring which has a small reproductive organ has a "slack" abdomen. The fat in the immature herring sometimes fills up a compact, clean abdomen and gives it rigidity. In the tables I have restricted the term "Full" to herrings in which the roes contained eggs measuring 1·0 mm. and upwards in diameter. Males which had testes 20 mm. in breadth and over were labelled "Fulls." Small herrings were, however, full when their reproductive organs were less than 20 mm. in breadth. The following cases occurred in February. A male, 17 cm. in length, was full, although the testes was only 10 mm. wide. Two full males, 18 cm. in length, had testes 12 and 14 mm. in breadth; two at 19 cm. had testes 14 and 19 mm. broad; three at 20 cm. had testes 13 and 17 mm. broad; while one at 21 cm. had testes 18 mm. wide. A female, 19 cm. long had eggs 1·0 mm. in an ovary 13 mm. broad, while another of the same length had eggs 1·1 mm. in diameter in an ovary 15 mm. wide. Two females, 20 cm. in length, had ovaries 12 and 13 mm. broad, containing eggs 1·0 mm. in diameter, while two that measured 21 cm. in length had eggs 1·1 mm. in diameter, in ovaries 16 and 17 mm. broad.

The males are often a little in advance of the females in the development of the reproductive organs. Thus males are sometimes found apparently ripe, while the accompanying females have not reached that condition. It is not at present clear how long a time may elapse after the fish arrives at a full condition before spawning takes place.

The appearance of the reproductive organs has been discussed under each month. It is not necessary to recapitulate what has been already stated. Owing to the great variety of conditions it is necessary to take into consideration the time of year when discussing the reproductive organs and their development.

The stage of a reproductive organ is indicated in some measure by its colour. A developing ovary is pink. When the yolked eggs become large the ovary becomes white in colour, with the blood-vessels prominently shown. Sometimes the infiltration of oil from the abdominal organs into the ovary after the death of the fish causes the white eggs to become translucent, and in that way the ovary may appear to be further advanced than it actually is. When quite ripe the ovary loses its white colour and becomes translucent.

The testis when small and developing is pink in colour. When ripe it is white and contains the white pasty milt.

Up to a certain period of the life of the fish the ovary and testis only grow to a preparatory condition and then rest. Six months before the herring will spawn it will be found to have laid up a large store of fat in the abdomen. This quantity of fat is not a provision for the growth of the body. The immature herrings, 13 to 21 cm. in length, in December had large quantities of abdominal fat, but they had nevertheless been feeding largely, for their stomachs were full of copepods. The presence of the fat indicates that the food supply has been more abundant, even in the winter season, than was necessary for the growth of the fish. The fish, therefore, has stored up the excess of nourishment in the form of rolls of fat, which are a reserve for the formation of the roe and milt.* When in this condition, that is, where a very small reproductive organ is accompanied by a large quantity of abdominal fat, the herring is known as a "matje." Spawning, then, appears to take place at a period in the life of the fish when it is able to assimilate more food than it requires for growth.

Fulton suggests that the fat found in the abdominal cavity of the herrings caught in autumn is probably used up not only in connection with the development of the reproductive organs, but also for the production of energy in tiding over the winter, when growth and even the power of digestion is to a large extent in abeyance.

The presence of much abdominal fat in an immature herring in winter or summer is a probable indication of impending maturity, viz., that the reproductive organs are about to start ripening in order to spawn in six months' time.

In February the immature herrings which will spawn during the coming summer may thus be detected. In the following Table are set out the conditions as to the quantity of abdominal fat observed in those immature fishes in which the character was noted. The immature developing herrings are omitted. The amount of fat is shown in four quantities—none, some, much, and very much.

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* See also p. 64.

Quantity of Abdominal Fat in Immature Herrings in February.

Length of Fish.	None.	Some.	Much.	Very Much.
cm.				
8	3	..	1	..
9	7	2	3	1
10	6	2	1	..
11	4	..	..	..
12	1	..	..	..
13	2	1	..	6
14	3	..	..	21
15	..	..	..	10
16	..	..	1	27
17	1	..	..	42
18	..	1	1	47
19	..	..	..	16
20	..	..	1	5
21	..	..	1	2
22	..	..	1	1
23	..	..	..	1
26	..	1	..	..

Most of the larger immature herrings, *i.e.*, from 13 to 23 cm., have very much fat. They form the first summer-spawning group. The herrings 8 to 17 cm. long, which have "no fat," are, I believe, a group of herrings six months younger than the first. The small herrings 8 to 10 cm., which had "much" and "very much" fat, constitute a difficulty. They are too small to belong to the first summer-spawning group.

Herrings which have already spawned also become apparent "matje" herrings. Six months after spawning they have laid up fat in great quantity, and the reproductive organ has shrunk to a small size. Huxley said that if the spent fish escapes its myriad enemies, it doubtless begins to feed again, and once more passes into the "matje" state in preparation for the next breeding season. Sim questioned this statement. He maintained that a fish that has once spawned cannot return to the "matje" condition, which is strictly that of herring that has not yet spawned. In this I think Sim was right. I am of the opinion that "matjes" which have spawned before have a deeper body than true "matjes" (Immatures). But, on the other hand, the very small reproductive organ might pass for an immature organ, and the fish would be accepted for trade purposes as a "matje." This condition is noted in summer, specially in connection with the winter spawners. The "matjes" which had been summer spents no doubt exist, although they are not fished.

The reproductive organ now starts to develop. It grows at the expense of the fat rolls. It seems to be able to divert all nutrition to itself, and to deplete the general tissues, if necessary, in order to get the necessary nourishment for its ripening ova. The extent to which the general tissues will be drawn upon will depend on the quantity of food available for the herring during the period. The summer-spawning herrings are better situated during that time than are the winter spawners. But from the fact that the herrings appear in February with large quantities of abdominal fat, it is evident that the herrings must, during the winter, have a sufficient, if not an abundant, supply of food. The winter spent, however, seems to be more emaciated than the summer spent.

The store of fat permits the herring to grow in length and keep in good condition while the reproductive organs are ripening. Heincke divided the year of a spent Schlei herring into three portions, viz. :—(1) A recovering and fattening period after spawning. It lasts three or four months. This is the main feeding-time. The emaciated body is filled up, and enormous stores of fat are laid down in the abdomen. (2) The ripening period of six to seven months. The herring eats much, but with a reducing intensity, and the several organs ripen at the expense of the fat. (3) The spawning period, which lasts about two months. The desire for food is extinguished, and the instinct of reproduction completely dominates the fish.

It would seem as if there were a factor that determines the season when the young fishes will leave the immature group. That is fixed by the locality in which the fishes live. It is probably different for the coast waters than it is for the open sea.

After spawning, the ovary returns to a quiescent preparatory condition. Food is then distributed through the tissues; growth takes place rapidly, and fat is stored up. In about six months time the fish has arrived at a "matje" condition. The reproductive organ having passed through its preparatory and seemingly resting condition, begins to ripen again, and to make the great demand on the energies of the fish.

The Rate of Growth.

Fulton discusses the question of the rate of growth of the herring, and gives a resumé of the different opinions which have been held as to the age at maturity.

The smallest size at maturity was given by Huxley at 17·5 cm. (7 inches), by Matthews as 18·5 cm. ($7\frac{3}{8}$ inches), by M'Intosh and Masterman as 20 to 22·5 cm. (8-9 inches), by Cunningham as 20 to 21 cm, (8 to $8\frac{1}{2}$ inches), and by Fulton as 24 to 27 cm. ($9\frac{1}{2}$-$10\frac{5}{8}$ inches).

Meyer found the herrings in the neighbourhood of Kiel ripe when between 16 and 20 cm. in length. Heincke gives 18 cm. ($7\frac{1}{5}$ inches), and Jenkins 19 to 19·8 cm. ($7\frac{1}{2}$-$7\frac{13}{16}$ inches) for the same. Each local form will, according to Heincke, have its own minimum size at first spawning.

The age at first maturity has given rise to much difference of opinion. Thus Huxley considered that the herring might become mature when eighteen months old, while Sim and Cunningham believed that spawning took place at the end of two years. M'Intosh and Masterman said that it probably occurred during the third year; Fulton assigned it to the fifth year.

For the Kiel herrings Meyer gives two years as the age at first spawning, while Jenkins, from a study of the otoliths, believed that this event did not occur till the third year. Schneider agreed with Jenkins.

Dahl, who investigated the rate of growth from an examination of the scales, came to the conclusion that the Norwegian spring herrings measuring from 25 to 37 cm. in length were from three to at least fourteen years of age. He maintained that the herrings grew at different rates in different localities—that the Norwegian herring when five years old measured 26 to 31 cm., while the Lowestoft herring at the same age measured 21 to 26 cm. He thought, moreover, that the small herrings in the fjords grew more slowly than the herrings of the ocean. The Nordland Fat Herrings are, according to this zoologist, $2\frac{1}{2}$ to $4\frac{1}{2}$ years old, and they have never spawned. Prince says that herrings 8 to 11 inches (20 to 28 cm.) cannot be less than three years old, and may be in their fourth year.

I have attempted to determine the rate of growth from the samples of herrings here investigated. There is no simple method by which this can be done. If it were possible to get a complete sample of all the herrings in one area at a time, it might be possible by the measurement of the same to arrive at a separation of the herrings into year-groups. But that could not be done by confining attention to the length of the fish. Many other factors must be noted.

Are the samples herein described representative of the shoals of which they formed part? The net is selective in that it allows the fish below a certain size to escape, and may fail to take those above a certain size. The seine net has a larger range than the drift net. The sprat net of the Tay takes the very small fishes which both the seine and the drift net permit to escape. The sample of fishes, therefore, is sometimes really a description of the net, not of the shoal. This fact seems to be markedly brought out in the case of the seine net in the Clyde. Where the sample contains small herrings, the smallest size is very often the same in different lots. The following list gives the smallest size of the herrings occurring in the samples caught by seine for each month:—February, 14 cm.: April, 14 cm.: May, 14, 15 cm.: June, 15, 16 cm.: August, 14, 17 cm.: September, 14 cm.: November, 14 cm.: December, 13 cm. It is very clear that 14 cm. does not mark the lower limit of the shoal, but the lower limit of the catching size of the seine net.

A second difficulty is the following:—How far is a shoal an age-group? Is it composed of herrings of one age and class?

There is no fixed separation of age-groups from one another, at least to the exclusion of one from the area occupied by the other. The mere fact that small fishes are exposed to the attack of large fishes does not mean that they cannot occupy the same area. Their survival depends on other factors.

In the case of herrings which are not liable to be devoured by each other, there is nothing to hinder them mixing to any degree. And the mixing of different classes of herrings is very apparent in the Clyde. Thus summer and winter spawners are found together. Brook said there were two or more classes of herrings in Loch Fyne in summer. The fishes there were a mixed collection of summer and winter spawners. Ripe fishes and spents may be taken in the same haul. All the evidence goes to show that herrings, wherever they meet, shoal together for protection, but if food becomes scarce they separate in search of it, to join up again with other herrings when their hunger is satisfied. The little herrings in the tank at the Laboratory showed a tendency when hungry to go individually, but when fed to rush off to their fellows and keep close together. The feeding shoals then may be continually changing in their composition, various lots of herrings giving temporary adhesion to any one body of fishes.

If, however, it should occur that a shoal is an age-group, it is very unlikely that the minute sample of herrings examined will contain the complete range in size, since both the very small and the very large individuals will be extremely few in number. The sample will probably give a piece out of the middle of the curve of sizes, and it may give approximately the mode. It is, moreover, possible that the very big individuals of an immature group might leave their smaller fellows and join a shoal of adult herrings.

The age-groups are becoming rapidly reduced in numbers as they grow older, and the fishes composing them grew longer. The curve representing the numbers of all herrings at each length is a steadily descending one. Out of this curve, then, each net may simply nip a sample suited to its own character. It will not work sharply at its limits of capture, and the sample may probably tail off gradually at each end, giving an apparent age-group. If two age-groups are mixed in a shoal the older group may simply form a good tailing-off of the upper end of the more numerous younger fishes.

In order to eliminate as far as possible errors due to selection by the nets, or by the consignor, all the herrings for each month have been added together, *i.e.*, in their respective classes, viz., Immature, Immature developing, Full herrings, Winter Spawners developing, Summer Spawners developing, Winter Spents, Summer Spents. They have been taken together irrespective of locality, or of the year in which they were captured. They have been arranged in the order of their length in the tables which follow*:—

IMMATURE.

Length.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
cm.												
5	..	..	..	..	..	..	..	..	..	..	..	22
6	..	..	..	..	..	..	..	2	..	..	..	31
7	..	4	..	..	..	..	..	24	..	..	..	63
8	..	13	..	..	..	..	..	6	..	..	..	26
9	..	45	..	..	..	..	..	..	..	..	..	49
10	..	77	..	..	..	2	..	..	..	3	..	67
11	1	88	..	..	..	3	..	..	..	..	..	55
12	1	63	..	..	4	7	..	..	..	2	2	51
13	1	53	..	..	10	9	..	..	..	..	2	30
14	1	43	..	7	7	2	..	1	2	..	2	19
15	5	29	..	12	4	2	..	15	30	..	3	17
16	1	45	..	13	4	11	..	28	80	..	15	36
17	3	88	..	10	2	48	..	44	50	..	22	45
18	1	84	3	16	24	49	..	60	108	..	5	30
19	8	30	1	41	75	43	..	49	136	3	5	18
20	3	9	3	91	52	45	..	34	48	3	5	10
21	2	4	..	90	32	41	2	13	5	6	1	6
22	6	5	2	33	13	43	1	8	2	..	..	4
23	9	2	2	13	11	39	1	7	2	1	..	2
24	..	..	..	1	3	39	..	5	..	1	..	..
25	1	..	..	..	2	17	..	3		..	..	..
26	..	..	..	..	..	4	..	..	..	..	..	..
27	..	..	..	..	..	4	..	..	..	..	..	..
28	..	..	..	..	..	1	..	..	..	..	..	..

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* The herrings contained in the additional samples recorded on page 67, are not included in the Tables pp. 59 to 62.

[TABLES.

IMMATURE DEVELOPING. **

Length.	Jan.	Feb.	Mar.	April.	June.	July.	Aug.	Sept.	Oct.	Nov.
cm.										
15	3	..	..	..	..	..	..	..	..	..
16	4	..	..	..	..	..	..	..	..	..
17	24	4	..	..	..	..	1	..	..	..
18	34	10	..	1	..	..	4	..	..	..
19	19	18	..	..	..	..	5	..	4	1
20	10	1	..	..	..	..	5	1	6	..
21	11	4	..	1	..	..	7	4	10	..
22	7	3	1	1	2	..	16	11	9	..
23	2	..	1	..	1	..	13	10	4	..
24	5	1	..	..	2	..	16	6	2	..
25	..	..	..	..	..	..	18	1	..	..
26	..	1	..	..	..	*1	8	..	..	..
27	..	..	..	..	..	*1	4	..	..	..
28	..	..	..	..	..	*1	*1	..	..	..
29	..	..	..	..	..	..	..	.	..	..
30	..	..	.	..	..	*1	..	..	..	..

* Shetland.
** In December there were the following—19, 19, 20, 21 cm.

FULL HERRINGS.

Length.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
cm.												
17	..	*1	..	..	..	..	..	..	..	..	..	..
18	..	2	..	..	1	..	..	..	..	..	..	..
19	..	5	..	..	..	..	..	..	..	..	..	..
20	..	5	2	1	.	..	..	..	..	..	..	..
21	..	7	15	1	..	..	..	..	..	..	..	.
22	1	9	13	1	..	1	1	..	..	..	..	7
23	14	26	8	6	..	..	6	7	..	1	1	3
24	13	27	9	5	..	1	8	11	..	2	2	17
25	19	31	11	7	3	2	17	23	..	2	15	13
26	13	23	17	3	1	3	16	12	6	8	20	22
27	23	19	21	4	.	2	8	9	3	9	21	1
28	32	29	14	..	..	..	5	18	2	2	10	..
29	26	23	3	1	..	..	7	19	8	1	4	1
30	20	25	..	..	..	..	6	26	7	8	16	7
31	14	9	1	..	..	..	14	12	5	8	15	9
32	3	3	..	..	..	..	8	13	1	9	2	7
33	..	1	..	..	..	..	2	3	..	3	..	1
34	..	3	..	..	..	..	..	..	..	..	..	..
35	..	.	..	..	1	..	..	..	..	..	..	..

* 170 mm.

WINTER SPAWNERS—DEVELOPING

Length.	Jan.	Feb.	Mar.	Apr. to June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
cm.										
17	..	1	..	..	..	..	..	..	1	..
18	..	4	..	..	1	..	..	..	1	1
19	2	8	..	..	9	..	..	..	3	4
20	2	3	..	..	20	1	..	3	7	9
21	8	4	1	..	53	3	3	4	9	29
22	12	12	..	..	57	9	8	9	8	11
23	10	3	..	..	83	23	16	16	12	21
24	4	2	..	..	55	11	19	15	16	13
25	13	3	1	..	22	12	34	19	23	15
26	3	2	..	..	20	7	20	12	60	19
27	..	..	..	..	15	9	11	8	34	4
28	..	1	..	..	11	12	2	4	9	1
29	..	2	..	..	5	10	1	2	3	2
30	..	..	..	..	3	9	..	10	..	..
31	..	..	..	..	2	14	..	11	1	..
32	..	..	..	..	..	7	..	6	..	1
33	..	..	..	..	..	1	..	1	..	..
34	..	..	..	..	..	1	..	..	..	..

WINTER SPENTS.

Length.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
cm.								
18	..	..	..	..	..	1	..	..
19	..	3	7	..	1	11	..	..
20	..	3	16	4	3	12	..	..
21	..	25	50	22	9	12	9	..
22	1	40	92	33	26	11	18	..
23	2	55	119	46	58	45	52	1
24	2	70	110	58	94	49	29	1
25	1	77	115	92	91	77	18	1
26	6	69	89	103	89	75	6	1
27	..	40	63	79	63	38	6	..
28	2	19	13	40	20	13	3	..
29	..	5	3	12	16	1	3	..
30	1	3	3	5	5	1	..	..
31	1	2	..	..	1	..	1	..
32	..	..	..	..	..	..	1	..
33	..	1	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..
35	..	..	..	1	..	1	..	..

SUMMER SPAWNERS—DEVELOPING.

Length.	Jan.	Mar.	April.	May.	June.	July.	Aug.
cm.							
17	..	..	1	..	..	..	..
18	..	1	1	..	1	..	..
19	.	2	2	..	1	..	..
20	1	3	1	1	2	..	..
21	1	6	4	..	..	1	..
22	2	5	15	2	3	22	8
23	9	1	47	12	15	28	19
24	3	1	55	15	19	32	12
25	1	.	30	16	25	19	1
26	..	..	8	9	19	25	3
27	..	..	1	7	15	15	1
28	..	..	..	1	1	11	3
29	..	..	..	..	..	7	..
30	..	..	..	..	..	9	4
31	..	..	..	..	..	17	..
32	..	..	..	..	..	7	..
33	..	..	..	..	..	3	..

SUMMER SPENTS.

Length.	Jan.	Feb. to May.	June.	July.	Aug.	Sept.	Oct.	Nov.
cm.								
21	*	..	*	*	..	..	..	2
22	..	..	8	1	1	..	..	3
23	..	..	22	1	..	4	..	5
24	1	..	35	..	10	5	..	1
25	1	..	15	..	5	8	..	2
26	2	..	17	5	10	18	..	1
27	2	..	1	9	3	8	1	..
28	..	..	..	1	..	17	..	..
29	1	..	..	4	..	21	..	..
30	..	..	..	..	2	12	..	..
31	..	..	..	..	..	..	..	..
32	..	..	..	..	..	1	..	..

* Spents of previous summer.

There are some herrings out of the total number dealt with in the research which have not been included in the preceding Tables. They are as follows :—In February 27 herrings, 17 to 23 cm. in length, were judged to be spring spawners. Their reproductive organs were not sufficiently advanced to permit them being regarded as winter spawners, and they were nevertheless so far developed that it was likely they would spawn before summer. In August two spents, 27 and 28 cm. in length, were diagnosed as spring spents. In December 7 herrings, measuring from 17 to 22 cm. in length, were taken as spring spawners. They appeared to have just left the immature group. Ninety-two herrings, 19 to 28 cm. long, in June were not classified; they were probably composed of immature and winter-spent herrings.

The first point to be determined is the smallest size of maturity. For this purpose attention may be directed to the winter-spawners, which are shown in "Fulls," Table, p. 60; Developing, Table, p. 61; Spents, Table p. 61. The winter-fulls are seen in February to vary in length from 17 to 34 cm. The developing winter-spawners range from 17 to 29 cm., while the spents in February, March, and April range from 19 to 32 cm. in length. The smallest size of the winter-spawning herring at maturity is 17 cm.

The upper limit of the first spawning group may be got from a study of the Tables of Immature herrings, p. 59, and of the Immature developing herrings, p. 60. The immature winter-spawners, which will become ripe for the first time in February, leave the immature group during the previous summer. In June the upper limit was 28 cm.; in August the upper limit of the specimens obtained was 25 cm. In July a few immature developing herrings measured from 26 to 30 cm., and in August the same class was represented by the series 17 to 28 cm. The immature developers soon become merged in the developing winter-spawning group. Taking 30 cm. as the upper limit of the immature developers in August, it may be taken for granted that the fish of that size will by February have grown in length. In March and April the full herrings were from 20 to 29, 31 cm., and 20 to 29 cm. respectively. I take 30 cm. as the upper limit of the first spawning group.

The first spawning group of winter-spawners may therefore be taken as from 17 to 30 cm.

It is now necessary to determine the lowest size of this group when it is a year older and is spawning for the second time. During the year the winter-spents have been traced for several months, *vide* Table, p. 61. In June they measured from 19 to 31 cm., in July from 18 to 30 cm., in August from 21 to 32 cm. Beyond the last-mentioned month the spents were not recognisable, but were included in the developing winter-spawners. The developing winter-spawners measured in September 21 to 29 cm., in October 20 to 33 cm., in November 17 to 31 cm., in December 18 to 32 cm. These lots of fish probably include both first and second spawning groups. In January most of the winter-spawners were full. They measured 22 to 32 cm., while the developing members measured from 19 to 26, 33 cm. In October the full herrings measured 23 to 32 cm., in November 23 to 32 cm., in December 22 to 32 cm. I regard the sizes 22 to 32 cm. as representing the second-spawning group. There would appear to be an indication, as Smitt says, that the herrings which spawn early in the winter have spawned before, while those which spawn at the end of the season are spawning for the first time.

So far as the material goes, a similar relationship is shown in the summer-spawning group. The immatures that are to spawn in summer leave the immature group in winter. The immatures in winter do not seem to be so large as those of summer. The largest sizes were 23 and 25 cm. for immature, and 26 cm. for an immature developing. The immature developers in February were from 17 to 26 cm. But in January the representatives of this stage measured from 15 to 24 cm. And judging by the amount of fat present in the immature herrings 13 to 23 cm. in length in February, it was indicated that these herrings would soon leave the immature group and would probably spawn during the summer, *vide* p. 56. It is therefore probable that 17 cm. is not, during February, the lowest limit of the first summer-spawning group. In July the summer-spawners measured from 21 to 33 cm. I do not think the smallest mature herrings are represented in this sample. The lower limit is probably as low as 18 cm. By applying the generalisation that the last herrings to spawn in the season are probably spawning for the first time, the upper limit of the first summer-spawning group would be taken as 30 cm. The developing summer-spawners measured in August 22 to 30 cm. in length. I think, then, that the first spawning group of summer-spawners may be represented by the lengths 18 to 30 cm.

What is the age of the herring when it spawns for the first time?

Attention may be directed to the immature herrings obtained in February. It may be taken for granted that a fish derived from eggs spawned in winter will itself spawn in winter. In the Firth of Tay, in two separate samples, the immature herrings ranged from 7 to 19 cm. and from 8 to 20 cm. respectively. The herrings leaving the immature group are 17 to 26 cm.; but, as I have indicated above, I consider the lower limit should be less than 17 cm. This group is the first summer-spawning group. There is also present a group six months younger, viz., a winter-spawning group. What, then, is the upper limit of the winter-spawning group among the immature herrings? If the matter be tested by the amount of abdominal fat present, the limits of the herrings having no abdominal fat give 8–17 cm., *vide* p. 56. But the amount of abdominal fat is not an altogether satisfactory standard. A number of herrings 8 to 10 cm. in length had much abdominal fat, so that the presence of abdominal fat is not necessarily associated with an impending maturity. When restricted to herrings 13 cm. and over in length it appears to be of value. I consider that the limits 7 to 17 cm. form part of a winter-spawning group six months younger than the first summer-spawning group. This winter-spawning group is, I think, one year old. The herring, I am therefore of the opinion, spawns at two years of age.

The herrings obtained in December in the Tay, measuring from 5 to 15 cm., would be 10 or 11 months old.

The following Table exhibits the age of certain samples, so far as I have been able to determine :—

February.—Herrings, 7–(17) cm. ($2\frac{3}{4}$–$6\frac{3}{4}$ inches) long—1 year old; winter-spawners.

February.—Herrings, 17–29 cm. ($6\frac{3}{4}$–$11\frac{3}{8}$ inches) long—2 years old; winter-spawners.

February.—Herrings, 22–32 + cm. ($8\frac{3}{4}$–13 inches) long—3 years old; winter-spawners.

February.—Herrings, 17–26 cm. ($6\frac{3}{4}$-$10\frac{1}{4}$ inches)—18 months old; summer-spawners.

June.—Herrings, 18-28 cm. ($7\frac{1}{8}$-11 inches)—22 months old—summer spawners.

The 18 months old winter-spawners (in summer) appear to be larger than the summer-spawners at the same age (in winter). The latter had in their short existence passed through two winters and one summer, while the former have had the advantage of two summers and one winter. That may account for the appearance of the large immature herrings in summer.

As the spawning period is very extended on either side of the principal month in both winter and summer, it follows that there must be a considerable range in the size of the herrings in February. It may happen that this range may be gradually reduced as the herrings grow older, since the rich feeding season of spring and summer may give the backward herrings the opportunity of making up some of their leeway.

My results, then, are in agreement with those of Sim and Cunningham on the question of the age at first maturity—that is, two years. The smallest mature herring which I have examined was 17 cm. in total length, *i.e.*, just under 7 inches, which was given by Huxley for the smallest ripe fish.

Spawning Seasons.

Ewart records that from the specimens of herring ova which he received from week to week it was evident that spawning took place off the Aberdeenshire coast from August 1883 to June 1884, a period of ten months. Schneider says that at Karlshamn (Baltic) spawning and spent herrings were captured throughout the year.

The Table of Full herrings, page 60, gives an indication of the extent to which spawning takes place in Scottish waters. Spawning may be regarded as starting in July and continuing to the following July. During that interval spawning rises to the two maxima—(1) Summer, viz., August–September, and (2) Winter, viz., February–March. There is evidently a considerable amount of spawning taking place in autumn. Brook found ripe herrings in September and October. Milroy records herrings practically ripe, with eggs 1·2 mm. in diameter, from Loch Fyne, Lochboisdale, and the Moray Firth in December.

Between April and July spawning is at a minimum. Brook said that a race of herrings spawned in the Campbeltown district in May. During this research some Clyde herrings, 27 in number, measuring from 17 to 23 cm. in length, showed in February a condition of the reproductive organs that suggested the possibility of their spawning in the interval between the winter and summer spawnings. Additional samples obtained in December and January (*vide* p. 67), point to this condition occurring regularly.

The dominating factors of the spawning are the spring and summer seasons. The liberal supplies of food then available determine the spawning to follow the summer at a shorter or longer interval.

Each locality has very definite spawning seasons. This fact points to the fishes themselves being localised and dependent on the local conditions of the food and the temperature and salinity of the water of the region.

The autumn spawning season is made up of late summer-spawners and early winter-spawners.

Brook found ripe males in Loch Fyne in July, and both males and females ripe in August.

How long will it be after a fish has an ovary containing eggs 1·0 mm. in diameter before it spawns? That will, no doubt, depend directly on the food supply, and while it may be soon in summer, may be lengthened out considerably during the latter half of the year.

Brook was of the opinion that some of the Clyde herrings might spawn twice in a year. There does not, however, seem to be any proof of this contention.

Matthews pointed out that the reproductive organs of herrings obtained from the Campbeltown district were larger than those of some East Coast herrings. I believe that a herring that is spawning for the second time may have a larger reproductive organ than a fish of the same size which is spawning for the first time.

Food.

In nearly all the samples some of the herrings had food in the stomach, or remains of food in the gut. The nature of the food that has been found in the stomachs of the herrings has been treated by Dr. Scott.

In the preceding part of the paper I have added, after the description of each sample, a note as to the presence or absence of food.

The stomach was found in several definite conditions—(1) It contained food. The stomach was then a thin-walled bag. (2) It was empty. Sometimes it was a big thin-walled bag. This condition indicated that the fish had been feeding. The stomach may have been empty in consequence of the fish having disgorged its food when captured.

The empty stomach was sometimes shrunken, and in a dry condition. This was found in full herrings. It was occasionally squeezed flat between the two large roes or milts. This indicated a more or less inactive condition of the stomach, but it did not mean that the fish could not feed if it wished. Full herrings very often have very little food in the stomach, but they feed. In some cases food was found in the anterior part of the stomach, while the lower end, beyond the pylorus, was pressed flat between the two large reproductive organs. In one lot of fish, although the reproductive organs were very large, the stomachs were fully distended with food.

Food was found in the stomachs of the Summer Fulls of the East Coast. The Winter Fulls of the Clyde usually had a large quantity of food (schizopods and copepods) in their stomachs. The ripe herrings got on Ballantrae Bank in February had empty stomachs. In March the stomachs of eight ripe herrings from the same locality were examined. One contained food, the other seven were empty. Sim found full herrings with their stomachs crammed with crustacea. Matthews also drew attention to the food in the stomachs of ripe herrings. The migration of the herrings from Loch Fyne at the end of the year is probably due to the necessity to find food.

When the stomach of the herring is large and filled with food it is generally referred to by the fishermen as a "bag" or "gut-poke." The bag may be of different colours, according to the nature of the food which fills it. Thus, a red bag is filled with copepods, a purple bag with the larvæ of decapod crustacea, a brown bag with *Limacina* and copepods, a blue bag with crustacea and young fishes (sand-eels). The gastric juice that is present in the stomach containing food very soon attacks the wall of the abdomen, and causes the splitting of the belly of the herring.

Milroy stated that "it is possible that for a short time (a month perhaps) after spawning the herring does not take food." I do not think that this is likely to be the case. The herrings seem to feed eagerly immediately after spawning. During February, March, and April, in the samples from the Clyde where the condition of the stomach in the winter spents was noted, food was found in the majority. Watt stated that the spent herrings, instead of crowding together as they did before spawning, begin to look after their prey with great keenness, and to spread themselves over a wide area of sea, most probably without regard to locality or special order in their movements.

The search for food is given by Sim and Watt as the reason for the migration shorewards of the mattie herrings in the summer. Sim also says that the food may be blown by the wind, and the herrings follow it. According to Brook, the floating masses of copepods are easily affected by the wind and tide, and according to the direction of the wind the copepods (and therefore the herrings) may, in Loch Fyne, be expected in certain quarters. This is not an infallible guide, but it serves as a basis to work on.

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II.—REPORT ON THE OPERATIONS AT THE MARINE FISH HATCHERY, BAY OF NIGG, ABERDEEN, IN 1908. By Dr. T. WEMYSS FULTON, F.R.S.E., Scientific Superintendent.

In last year's report, in describing the work of the hatchery in 1907, it was stated that, owing to the small numbers of adult plaice in the spawning-pond, the number of fertilised eggs obtained was the smallest since the hatching operations were begun. In previous years it was the practice to engage a steam-trawler to fish for the plaice for the hatchery either in Aberdeen Bay or the Moray Firth, but this arrangement was terminated at the end of 1905. In the latter part of 1907, through the co-operation of Professor D'Arcy Thompson, a considerable number of plaice suitable for breeding purposes were procured by the *Goldseeker* in the Moray Firth, and were brought to Aberdeen in tubs in the ordinary way. Although a tolerably large proportion of these died *en route*, or shortly after being landed—caused in large measure by the buffeting to which the vessel was exposed—the supplies were sufficient substantially to increase the quantity of eggs for the hatchery, and therefore the number of fry which was hatched. The quantity was still, however, far below what was available in former years under the old system, or what the capacity of the pond is adapted for.

The first eggs were obtained on 13th January, which is about the usual time, whereas in 1907 they were first collected on 25th February, the stock of fishes then being very small. The last lot of eggs was taken from the spawning-pond on 14th May, which is also about the usual time.

The total number of eggs which were collected in the course of the season was about 15,332,000, as compared with an estimated quantity of 1,626,000 in 1907. The number obtained in each month and the percentages to the aggregate are shown as follows:—

	Number of Eggs.	Percentage.
January	146,000	0·95
February	3,766,000	24·6
March	7,170,000	46·7
April	3,420,000	22·3
May	830,000	5·4
	15,332,000	

The quantity of dead eggs removed from the hatching apparatus (including, however, the shells of those which were hatched) was estimated at 3,056,000, or 19·9 per cent., which is a lower percentage than usual. In 1907 the death-rate was 21 per cent.; in 1906, 41 per cent.; and in 1905, 39 per cent. The reason for the lessened mortality is referred to below.

During the season the specific gravity of the water remained fairly constant at from 27·2 to 27·4. The water drawn from the beach (examined from the flow from the pump after a time) on two days in April fell to 26·0; while the highest reading at any time was 27·6. That in the pond was much the same, the highest reading being 27·6 and the lowest 26·8. In the hatching apparatus it was usually well above 27, but on one day (10th April) it fell to 25·6, and to 26 on the two following days.

The temperature of the water from the beach varied in January from 37·4° F. to 44·6° F., the average being 40·5° F.; the temperature in the pond was lower, ranging from 4·2° F. to 40·6° F., the mean being 37·3° F.; while in the hatchery it was intermediate. The particulars in regard to the average temperatures (in Fahrenheit degrees) in each month are as follows:—

	In Pond.		In Hatchery.		From Beach
	1907.	1908.	1907.	1908.	1908.
January . .	34·5	37·3	. .	40·0	40·5
February . .	35·1	40·0	. .	42·0	41·4
March	40·9	39·7	41·5	40·6	41·1
April	45·0	42·0	44·5	42·8	43·0
May	49·0	44·2	48·9	48·0	44·9

The water in the pond was thus colder in each month than that obtained direct from the beach, while that in the hatching boxes is, as a rule, intermediate in temperature. The lowest reading throughout the season was 36·7° F. for the pond, as compared with 32° F. on several occasions in the previous year; 37·8° F. for the hatchery and 37·4° F. for the beach. During several days in the latter part of April the temperature was unusually low, sinking to below 39° F. in the hatching boxes.

Owing to frequent storms, difficulty was sometimes occasioned in filtering the water thoroughly, and a slight modification was made so as to allow of the water running from the hatchery to be used again when the water on the beach was more than commonly turbid. This was done by interposing a concrete sink in the course of the outflow from the hatchery to the large spawning-pond, and joining up with it some lengths of fireclay pipe terminating in the filter-chamber. By means of wooden plugs the water leaving the hatchery could thus be directed at will either to the spawning-pond (and thence to the sea), its usual course, or to the filter-chamber, whence it could be again pumped to the gravitation tank from which the hatching apparatus are supplied. To this change, as well as to an alteration in the pipes passing from the filtering boxes, by which an additional "head" of about 17 inches was secured, is to be attributed the lowered mortality among the eggs in the process of incubation. A considerably stronger current was obtained and also cleaner water.

The first larvæ to be hatched out appeared on 7th February; and altogether, during the season, 12,296,000 fry were produced. These were put into the sea in eight lots between 19th February and 28th May. The first and the last lots, amounting in all to about 840,000, were distributed in the local waters at a distance of a mile or so from Girdleness. All the others, in quantities from nearly a million to over three millions, were distributed in the waters in the neighbourhood of Fraserburgh and Kinnaird Head, being taken thither in large carboys by rail and put away by means of fishing-boats at distances between 1½ and 2½ miles from land. The reason for this was twofold. The fishermen on the coast of Aberdeen have on several occasions petitioned that fry might be placed in the waters in their neighbourhood, in the belief that to do so is advantageous to them in their fishing. The second reason is that, owing to the movement of the current down the coast (southwards and eastwards), it is a very good locality for the liberation of the fry. In making the arrangements necessary Mr. W. J. Caird, of Sandhaven, rendered much assistance on all occasions, the fry being taken north under the charge of Mr. G. Walker, the hatchery attendant, and distributed by him. The particulars as to the quantities, dates, temperature of the sea, etc., will be found on the appended table (Table II.), and also the particulars as to the daily progress of the hatching, etc. (Table I.).

The number of the eggs of the plaice collected from the spawning-pond, and the number of the fry hatched out and liberated in the sea, in the various years since the hatchery was established at the Bay of Nigg are as follows:—

	Eggs Collected.	Fry Produced.
1900	43,290,000	31,305,000
1901	65,377,000	51,800,000
1902	72,410,000	55,700,000
1903	65,940,000	53,600,000
1904	39,600,000	34,780,000
1905	40,110,000	24,500,000
1906	7,486,000	4,406,000
1907	1,627,000	1,282,000
1908	15,332,000	12,296,000
	351,172,000	269,669,000

As has been mentioned in former reports, the cost of the fish-hatching work as carried on at the Bay of Nigg, in conjunction with the laboratory, is very small, amounting to an estimated sum per annum of about £80, which represents the extra expenditure for coals, oils, etc., and for occasional assistance to the attendant.

Table I.—Showing the Daily Progress at the Hatchery, and the Temperature and Specific Gravity of the Water.

Date.	Eggs Collected.	Dead Eggs Removed.	BEACH.		AIR.	POND.		HATCHERY.	
			Temp. °F.	Sp. Gr.	Temp. °F.	Temp. °F.	Sp. Gr.	Temp. °F.	Sp. Gr.
1908.									
Jan. 2	...	...	...	...	31·6	35·6	27·2	...	...
,, 3	...	...	...	...	29·1	34·2	27·2	...	...
,, 4	...	...	...	...	29·8	35·6	27·2	...	...
,, 6	...	...	38·1	27·2	43·5	36·7	27·2	...	...
,, 7	...	...	...	...	43·2	40·3	27·2	...	...
,, 8	...	...	...	...	37·8	36·7	27·0	...	...
,, 9	...	...	37·4	27·2	36·0	36·0	27·0	...	...
,, 10	...	...	...	...	35·6	35·6	27·0	...	...
,, 11	...	...	...	...	41·4	36·3	27·0	...	...
,, 13	A few.	...	...	...	37·8	34·5	27·0	...	...
,, 14	8,000	...	39·2	27·2	41·0	36·0	27·0	38·5	27·2
,, 15	10,000	...	...	...	44·6	36·7	27·0	40·3	27·2
,, 16	27,000	...	44·6	27·4	51·8	39·9	27·2	42·8	27·2
,, 17	2,000	...	...	...	47·5	40·6	27·2	43·5	27·4
,, 18	None.	...	39·9	26·8	38·1	38·8	27·0	40·6	27·4
,, 20	20,000	...	41·4	27·2	40·3	38·5	27·0	37·8	27·4
,, 21	10.000	...	41·0	27·4	39·6	37·8	27·0	38·5	27·4
,, 22	8,000	...	40·6	27·4	37·4	36·7	27·2	37·8	27·4
,, 23	8,000	...	41·0	27·4	45·0	38·5	27·2	39·2	27·4
,, 24	6,000	6,000	41·7	27·4	41·0	37·8	27·2	39·9	27·4
,, 26	...	...	41·0	27·2	41·4	37·4	27·2	39·2	27·2

TABLE I.—*continued.*

Date.	Eggs Collected.	Dead Eggs Removed.	BEACH.		AIR.	POND.		HATCHERY.	
			Temp. °F.	Sp. Gr.	Temp. °F.	Temp. °F.	Sp. Gr.	Temp. °F.	Sp. Gr.
1908.									
Jan. 27	27,000	...	40·6	26·8	45·0	38·8	27·2	41·0	27·4
,, 28	20,000	...	40·3	27·2	42·8	37·8	27·2	40·6	27·2
,, 29	...	...	40·3	27·2	43·9	38·5	27·2	40·3	27·2
Feb. 1	53,000	...	...	...	...	...	...	...	...
,, 3	50,000	80,000	...	...	...	...	...	...	...
,, 5	...	...	41·7	27·4	44·6	40·3	27·2	42·8	27·2
,, 6	20,000	...	41·7	27·4	46·4	41·0	27·2	43·9	27·4
,, 7	80,000	20,000	43·5	27·2	48·9	41·4	27·2	43·2	27·2
,, 8	40,000	...	41·7	27·2	43·5	39·9	27·2	42·8	27·2
,, 9	...	...	41·4	27·2	42·8	40·3	27·2	43·2	27·2
,, 10	200,000	...	41·0	26·8	48·2	38·8	27·2	39·9	27·2
,, 11	100,000	20,000	41·7	27·2	47·1	39·9	27·2	40·6	27·0
,, 12	120,000	...	41·7	27·4	45·0	40·6	27·2	42·4	27·2
,, 13	186,000	...	41·4	27·4	48·2	39·9	27·2	42·4	27·2
,, 14	180,000	20,000	42·1	27·0	47·1	41·0	27·2	42·4	27·2
,, 15	160,000	...	41·0	27·4	48·2	40·6	27·2	42·1	27·0
,, 16	...	...	42·1	27·2	48·2	41·0	27·2	43·2	27·2
,, 17	170,000	...	41·4	27·4	48·6	40·6	27·2	43·2	27·2
,, 18	260,000	10,000	41·0	27·4	48·2	40·3	27·2	42·8	27·4
,, 19	160,000	...	41·7	27·4	47·1	40·3	27·2	43·2	27·4
,, 20	220,000	...	41·4	27·2	48·6	41·0	27·2	43·9	27·2
,, 21	170,000	40,000	42·8	27·4	48·6	41·4	27·2	43·9	27·2
,, 22	180,000	...	42·1	27·2	48·2	41·7	27·2	43·9	27·4
,, 23	...	...	42·4	27·2	47·8	41·0	27·2	43·5	27·2
,, 24	380,000	120,000	41·0	27·4	42·8	39·6	27·2	41·0	27·4
,, 25	260,000	...	41·0	27·4	42·1	39·2	27·4	39·9	27·2
,, 26	187,000	...	41·0	27·4	41·7	38·5	27·4	40·6	27·4
,, 27	180,000	20,000	39·9	27·2	34·9	38·1	27·4	38·5	27·4
,, 28	240,000	...	39·6	27·0	34·2	37·0	27·6	38·5	27·2
,, 29	170,000	40,000	39·2	27·2	34·5	37·4	27·6	37·8	27·2
Mar. 1	...	...	39·2	27·2	37·4	37·8	27·4	37·8	27·0
,, 2	330,000	...	40·3	27·2	38·5	37·4	27·2	38·8	26·8
,, 3	200,000	...	39·2	27·4	38·8	37·4	27·2	38·8	27·0
,, 4	180,000	...	41·0	27·0	39·9	38·8	27·2	40·3	26·6
,, 5	200,000	160,000	41·0	27·4	41·0	38·5	27·4	39·6	27·0
,, 6	240,000	...	40·3	27·4	42·1	37·4	27·4	38·8	27·2
,, 7	...	...	40·6	27·2	42·8	38·1	27·2	39·2	27·2
,, 8	...	...	41·0	27·2	42·8	39·2	27·2	39·2	27·2
,, 9	520,000	...	41·0	27·2	43·9	39·9	27·2	39·6	27·2
,, 11	520,000	240,000	40·6	27·4	44·2	39·2	27·2	40·6	27·2
,, 12	580,000	...	40·6	27·0	44·2	40·3	27·2	40·6	27·2
,, 13	540,000	160,000	39·9	27·0	43·9	39·2	27·2	40·6	27·0
,, 14	360,000	...	39·6	27·4	38·8	38·8	27·2	39·6	27·0
,, 15	...	...	41·0	27·2	42·8	40·6	27·2	41·0	27·2
,, 16	320,000	160,000	41·4	27·0	42·8	40·3	27·2	41·4	27·2
,, 17	480,000	...	42·1	27·4	43·2	39·9	27·2	41·0	27·0
,, 18	400,000	...	42·1	27·4	43·2	40·6	27·2	40·6	27·2
,, 19	240,000	120,000	41·7	27·0	32·7	39·6	27·0	40·6	27·0
,, 20	240,000	...	39·6	27·2	39·9	38·8	27·0	40·6	27·0
,, 21	180,000	...	41·0	27·4	41·0	39·6	27·0	41·0	27·2
,, 22	...	...	42·1	27·2	47·1	40·6	27·0	41·0	27·2
,, 23	240,000	...	43·2	27·2	47·5	41·7	27·2	43·2	27·2
,, 24	200,000	160,000	...	...	...	...	...	...	...
,, 25	180,000	...	42·4	27·4	42·8	40·3	27·2	42·1	27·2
,, 26	160,000	160,000	42·4	27·2	41·0	41·0	27·2	42·4	27·2

TABLE I.—*continued.*

Date.	Eggs Collected.	Dead Eggs Removed.	BEACH.		AIR.	POND.		HATCHERY.	
			Temp. °F.	Sp. Gr.	Temp. °F.	Temp. °F.	Sp. Gr.	Temp. °F.	Sp. Gr.
1908.									
Mar. 27	160,000	120,000	42·4	27·4	43·2	41·7	27·2	42·1	27·2
,, 28	240,000	...	42·1	27·4	41·0	41·4	27·2	42·1	27·2
,, 29	...	...	42·8	27·2	42·1	41·7	27·0	42·8	27·2
,, 30	240,000	80,000	41·4	27·2	41·0	41·0	27·0	41·7	27·2
,, 31	240,000	...	40·3	27·2	40·6	40·3	27·2	39·9	27·2
Apr. 1	170,000	160,000	42·4	27·4	42·4	41·4	27·4	40·6	27·2
,, 2	160,000	...	42·1	27·4	41·0	40·3	27·2	41·7	27·4
,, 3	170,000	120,000	42·1	27·2	41·0	41·7	27·2	43·2	27·2
,, 4	120,000	...	42·1	27·4	41·7	41·4	27·2	42·1	27·4
,, 5	...	...	42·1	27·4	42·1	41·0	27·2	42·1	27·0
,, 6	160,000	80,000	43·9	27·4	46·4	42·8	27·2	45·3	27·4
,, 7	160,000	...	...	...	...	...	...	...	...
,, 8	160,000	200,000	44·2	27·2	44·6	42·4	27·2	44·2	27·4
,, 9	160,000	...	42·8	27·4	44·2	42·1	27·4	43·9	27·2
,, 10	160,000	200,000	44·6	26·0	43·9	45·0	26·8	45·0	25·6
,, 11	120,000	...	45·3	26·0	46·4	45·7	27·0	45·7	26·0
,, 12	...	...	44·2	26·8	43·9	42·8	27·2	44·2	26·0
,, 13	160,000	...	42·4	27·2	43·5	41·7	27·2	43·5	27·0
,, 14	120,000	120,000	43·9	27·4	44·2	42·8	27·2	44·6	27·2
,, 15	100,000	...	44·2	27·2	44·6	42·8	27·2	43·5	27·2
,, 16	160,000	...	...	...	...	...	...	...	...
,, 17	120,000	...	43·9	27·4	42·8	42·4	27·2	44·2	27·2
,, 18	40,000	...	44·6	27·2	41·7	43·2	27·2	46·0	27·2
,, 19	...	...	43·9	27·4	40·3	41·4	27·2	42·8	27·2
,, 20	120,000	200,000	41·0	27·2	39·9	39·6	27·2	41·0	27·2
,, 21	120,000	...	43·2	27·0	41·0	42·4	27·0	42·4	27·0
,, 22	80,000	...	41·4	27·2	34·9	39·2	27·0	41·7	27·0
,, 23	80,000	...	41·0	27·2	32·0	39·6	27·2	38·5	27·2
,, 24	160,000	...	41·0	27·2	30·2	39·2	27·2	38·5	27·2
,, 25	120,000	...	41·4	27·4	38·1	39·6	27·2	38·8	27·2
,, 26	...	...	42·4	27·4	46·4	41·0	27·2	39·6	27·2
,, 27	100,000	120,000	43·2	27·2	45·3	42·8	27·2	41·0	27·2
,, 28	200,000	...	...	...	...	...	...	...	...
,, 29	120,000	...	44·6	27·0	46·0	45·3	27·2	46·4	27·0
,, 30	80,000	...	42·8	27·0	44·2	43·2	27·0	44·6	26·8
May 1	80,000	...	42·8	27·0	43·9	42·8	27·0	44·2	26·8
,, 2	100,000	...	42·1	27·0	42·8	41·0	27·0	43·9	27·0
,, 3	...	...	43·9	27·2	42·1	44·6	27·0	44·2	27·0
,, 4	...	...	43·5	27·2	42·8	44·2	27·0	43·9	26·8
,, 5	100,000	...	44·6	27·0	46·4	44·6	27·0	46·4	27·0
,, 6	80,000	...	42·8	27·4	46·4	43·5	27·2	46·0	27·2
,, 7	60,000	80,000	44·6	27·4	46·0	45·0	27·2	45·7	27·4
,, 8	80,000	...	44·2	27·2	46·8	46·0	27·0	45·3	27·4
,, 9	80,000	...	45·3	27·6	47·8	46·4	27·0	46·4	27·0
,, 10	...	...	43·9	27·4	52·5	41·0	27·2	48·6	27·2
,, 11	70,000	40,000	44·6	27·2	54·0	42·8	27·2	48·2	27·2
,, 12	80,000	...	45·0	27·4	52·3	42·8	27·2	49·6	27·2
,, 13	80,000	...	46·8	27·2	53·6	45·7	27·2	50·4	27·4
,, 14	20,000	...	48·2	27·2	50·4	45·3	27·2	49·3	27·2
,, 15	...	...	48·2	27·0	53·6	45·3	27·2	50·0	27·0
,, 16	...	...	48·6	27·4	52·5	45·7	27·2	50·4	27·2
,, 17	...	...	49·3	27·2	60·8	44·6	27·0	52·2	27·2
,, 18	...	...	47·5	27·4	57·2	44·2	27·0	52·9	27·4
,, 19	...	...	46·4	26·8	51·8	44·6	27·0	51·1	26·8
,, 20	...	...	46·8	27·0	50·0	44·6	27·2	52·3	26·8

TABLE II.—Showing Particulars in connection with the Distribution of Fry.

Date.	LOCALITY.	Depth. Fms.	Surface Temperature of Sea. ° F.	Specific Gravity.	WEATHER.	No. of Fry.
Feb. 19	About 1 mile off Girdleness.	14	41·4	27·2	—	200,000
Mar. 10	About 2 miles off Fraserburgh.	15	41·5	28·0	Blowing hard, E.S.E.	960,000
,, 24	About 1¾ miles off Sandhaven towards Rosehearty.	15–20	42·8	27·8	S.-W.; showery.	1,520,000
Apr. 7	About 2 miles off Sandhaven towards Rosehearty.	25–30	42·9	27·6	S.-W.; fine.	3,040,000
,, 16	About 2½ miles off Sandhaven.	25–30	43·5	27·6	S.-W.; fine.	2,880,000
,, 28	About 1½ miles off, between Pitullie and Sandhaven.	30	44·2	28·0	S.-E.; strong.	1,856,000
May 12	About 1½–2 miles off, between Pitullie and Sandhaven.	30–35	44·0	27·8	N.-E.; fine.	1,200,000
,, 28	About 1¼ miles off Girdleness.	30	48·2	26·8	S.; fine.	640,000

III.—NOTES ON THE DISTRIBUTION OF PELAGIC CRUSTACEA IN LOWER AND UPPER LOCH FYNE.

By THOMAS SCOTT, LL.D., F.L.S.

The following notes on the distribution of pelagic crustacea in Lower and Upper Loch Fyne describe the results obtained by the examination of numerous tow-net gatherings collected during the four years from 1905 to 1908, both years inclusive.

The gatherings were collected at several fixed stations located in mid-channel, two of them being situated in Lower Loch Fyne and the others in the upper portion of the loch.

The outermost station in Lower Loch Fyne (Stat. I.) is situated in mid-channel and nearly due east of the north end of Barmore Peninsula, and the other (Stat II.) nearly midway between Maol Dubh Point on the west and Kilfinan Bay on the east side of the loch. Those in Upper Loch Fyne are arranged as follows:—Station III. is distant fully one mile and almost directly south-east of the village of North Kames; Station IV. is about three-quarters of a mile south-east of Kilmichael Beg; Station V. is midway between Pennimore on the west and Newton Bay on the east side of the loch; while Station VI. is situated off the mouth of the Douglas Water and distant north by east from Strachur about a mile.

Nearly six hundred gatherings have been collected during the four years. A small proportion of them (and nearly all in the first year) consisted of horizontal hauls; the others were vertical—that is, the net was lowered to the depth required and then hauled straight up. The gatherings are from various depths, regulated by the depth of water at the station where they were collected. At the deep-water stations, *i.e.*, the two in Lower Loch Fyne and Stations v. and vi. in the Upper Loch, a horizontal gathering was collected in the first year at or near the surface, and others at mid-water and bottom, while the vertical hauls were usually taken at intervals of fifteen fathoms, beginning at fifteen fathoms from the surface, down to sixty fathoms, and also one from the bottom if the depth was much over sixty fathoms.

The following is a tabulated list of the Stations, giving the number of gatherings, horizontal and vertical, collected at each of them during each of the four years:—

Numbers of the Stations.	Number of Gatherings Collected during—				Totals for each Station.
	1905.	1906.	1907.	1908.	
Station I. (Barmore) ..	49	24	21	10	104
,, II. (Kilfinan) ..	29	19	29	23	100
,, III. (Kames)	31	10	11	16	68
,, IV. (Kilmichael Beg) ..	30	10	12	9	61
,, V. (Newton)	43	21	21	30	115
,, VI. (Strachur) ..	60	25	24	34	143
Totals for each Year ..	242	109	118	122	591

The depth of water at Stations III. and IV. is much less than at the others, and scarcely reaches to thirty fathoms; therefore, as indicated by the Table given above, fewer hauls were taken at these stations.

As the gatherings were collected at different times of the year, as well as at different stations, they tend to indicate approximately the general distribution of the pelagic crustacea present in Loch Fyne during the four years referred to. The gatherings also exhibit evidence of local variation in the distribution of these organisms, and to some extent seasonal differences are also indicated;[*] but before this latter result could be satisfactorily dealt with the observations would require to be continued over a longer period.

The nets used were of a uniform size and fineness of mesh, but a few special hauls made off Inveraray, and at Station I. in October 1906, were taken, some of them with a large "mid-water net," and others with a "ring-net."

Pelagic Copepoda formed a large portion of the contents of the varions gatherings, the most common species being *Calanus helgolandicus*, Claus; many of the hauls consisted almost entirely of this species. Other forms were sometimes met with, but they seldom occurred in large numbers. A list of the species observed is given at the end of this paper.

The following is a short description of the quantities and contents of the gatherings collected during the four years at the different stations mentioned above. The quantities are given in cubic centimetres (c.c.'s).[†] The stations are taken in the order in which they occur in the Table.

STATION I.—LOWER LOCH FYNE. (E. OF BARMORE PENINSULA.)

1905.

The total number of gatherings from this station is about one hundred and four. Forty-nine of these were collected during 1905, and are shortly described below.

FEBRUARY.—Seven gatherings were collected in February. They comprised two horizontal and five vertical hauls. One of the horizontal hauls was collected at the surface, and one was a mid-water gathering; their contents, which measured about 25·5 and 10 c.c.'s respectively, consisted for the most part of *Calanus*. The vertical hauls were from 30, 45, 60, 75, and 90 fathoms. The haul from 30 fathoms measured 2·5 c.c.'s, that from 45 fathoms was badly preserved; the others, like that from 30 fathoms, were small gatherings, and measured respectively 2·5, 2·5, and 1·5 c.c.'s, and consisted for the most part of *Calanus*. The only other organisms observed were a few fish ova (in the surface gathering), a few *Euchæta norvegica*, *Bradyidius armatus*, *Pseudocalanus elongatus*, young *Mysis* sp., Sagitta and *Tomopteris*.

MARCH.—The eight gatherings collected in March included three horizontal hauls—one taken at the surface, one at mid-water, and one near the bottom. The surface and mid-water gatherings measured respectively 5·5 and 6 c.c.'s, and consisted chiefly of *Calanus*, but *Pseudocalanus elongatus* was moderately frequent in the surface gathering, and *Euchæta norvegica* in that from mid-water; the bottom horizontal haul contained a quantity of mud and was not measured The five vertical hauls collected in March were from 15, 30, 45, and 60 fathoms, and one from near the bottom (about 70 fathoms). All these gatherings were small, and contained only a few *Calanus*, *Pseudocalanus*, *Euchæta*, and one or two other common forms.

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[*] See pp. 94–96, tables for Stations III. and IV.; compare quantities for May 1905 and 1906 with those for 1907 and 1908 for the same month.

[†] The quantities of the various gatherings were estimated by my colleague, Dr. Williamson, as explained below, and he has kindly allowed me the use of his notes thereanent. A noted quantity of water was put into a glass measure graduated in centimetres. The tow-net collection was then poured out on to cheese-cloth similar to that of which the tow-nets are made. The mass of Copepoda was then transferred by means of a scapula to the glass measure, and the volume of the water and Copepoda was noted. From that amount the volume of the collection was found by subtracting the original quantity of water. When the Copepoda were on the cheesecloth a certain amount of the formaline solution in which they were preserved was included in the mass. No attempt was made to remove this, except that, when the collection was a large one, it was gently pressed with the fingers till the excess of fluid ran off.

April.—Eight gatherings, comprising three horizontal and five vertical hauls, were collected in April. The horizontal hauls consisted of a surface, a mid-water (35 fathoms), and a bottom (70 fathoms) gathering. The surface gathering measured only about 1c.c.; the other two were moderately large, and measured 26·5 and 49 c.c.'s respectively. The five vertical hauls were from 15, 30, 44, and 60 fathoms, and one from near the bottom, and measured 2·5, 5·5, 2·5, 2, and 2 c.c.'s respectively. *Calanus* was the most common species in these gatherings, but *Pseudocalanus* and *Centropages hamatus* were moderately frequent, and there were also a few others. The following numbers represent approximately the proportional numbers of the species observed in the gathering from 30 fathoms:—*Calanus* 500, *Centropages hamatus* 150, *Pseudocalanus* 100, *Euchæta* 2, *Acartia clausi* 5, together with a few *Evadne nordmanni, Podon leuckarti,* larval Balani, Ascidians, and fish eggs.

May.—Eight gatherings, comprising three horizontal and five vertical hauls, were collected in May. The horizontal hauls consisted of a surface, a mid-water, and a bottom gathering, as in April. The surface catch was a small one, and measured only 2·5 c.c.'s, in which *Calanus* and *Centropages* were about equally common, and constituted the chief part of the haul, but *Acartia clausi*, *Evadne*, and *Podon leuckarti* were also frequent; other forms observed included a few Sagitta, Oikopleura, and fish eggs. The mid-water and bottom hauls measured about 2·5 and 4·5 c.c.'s respectively; their contents did not differ much from the surface haul just described, except that it contained a few *Euchæta* and *Parapontella brevicornis.* The vertical hauls were from depths similar to those described under April, and measured 3·5, 3, 3, 5, and 7·5 c.c.'s respectively. The species observed in these gatherings did not differ greatly either in proportion or kinds from those mentioned above, except that *Temora longicornis* and *Anomalocera patersoni* occurred in the haul from 15 fathoms, and *Metridia lucens* in that from the deep water.

June.—Five gatherings, all vertical hauls, were collected in June. They were taken at depths similar to those already described, and measured 3, 11·5, 20·5, 25·5, and 55 c.c.'s respectively. The two last hauls consisted almost entirely of *Calanus.* The same organism constituted the largest portion of the other gatherings, but *Centropages hamatus*, *Pseudocalanus elongatus*, and *Acartia clausi* were also present in small numbers.

August.—Five vertical hauls collected in August measured respectively about 1·5, 2·5, 6, 50, and 14 c.c.'s. These measurements indicate a considerable decrease in the number of crustacea when compared with the June collection. These gatherings consisted almost entirely of *Calanus.*

September.—All the gatherings collected in September were vertical hauls. Those from 15, 30, and 45 fathoms were small, and measured only 1, 1, and 2·5 c.c.'s respectively. The haul from 60 fathoms measured 9·5 and that from 75 fathoms 25 c.c.'s. Each of these hauls shows apparently a still further falling off in the number of pelagic crustacea at this station. *Calanus* formed about half of the catch from 15 fathoms, the other half consisting for the most part of *Pseudocalanus* and *Acartia clausi* in about equal numbers. *Calanus* formed about 65 per cent. of the catches from 30 and 45 fathoms, and 75 per cent. of the two from deep water.

1906.

April.—Pelagic crustacea were apparently scarce at the Barmore station in April. Four vertical hauls were collected at 15, 30, 45, and 75 fathoms, but the catches were small. That from 15 fathoms contained about 100 *Calanus*, one or two *Centropages hamatus*, and a few larval Balani, while that from 30 fathoms contained about 200 *Calanus* and about half that number of *Pseudocalanus*. The catch from 45 fathoms differed little from the one just referred to, but though that from 75 fathoms was also small, *Calanus* and *Pseudocalanus* were rather more numerous, and there were also present a few *Centropages hamatus* and *Temora longicornis*, and one or two larval Balani.

June.—The next series of gatherings from this station were collected in June. They were vertical hauls from depths similar to those already mentioned, *i.e.*, 15, 30, 45, and 60 fathoms, and one from near the bottom (80 fathoms). In these gatherings pelagic crustacea were rather more plentiful. The first three hauls measured respectively 3·5, 10·5, and 9·5 c.c.'s, that from 60 fathoms 20 c.c.'s, and the one from 80 fathoms 25 c.c.'s. The contents of the various hauls consisted almost entirely of *Calanus*.

August.—Five gatherings were also collected here in August. The first four did not differ greatly in any way from those just described, but the last one (from 75 fathoms) was considerably larger than that collected in June, and measured 100 c.c.'s. *Calanus* and *Pseudocalanus* were present in about equal numbers in the first four gatherings, but the last one consisted almost entirely of *Calanus*. A few *Euchæta*, *Parapontella brevicornis*, *Rhoda raschi*, and Sagitta were observed in some of the hauls. The first four hauls measured respectively 3, 7·5, 15·5, and 20·5 c.c.'s.

September.—Five hauls were collected in September. The smallest was from 15 fathoms and measured only 1 c.c.; the next two from 30 and 45 fathoms were also small—they each measured 1·5 c.c.'s; those from 60 and 75 fathoms were considerably larger, and measured respectively 15·5 and 70 c.c.'s. The last two gatherings consisted almost entirely of *Calanus*, *Euchæta norvegica*, of which there were a few specimens, being the only other species observed. *Calanus* also formed the chief portion of the other gatherings, but a few specimens of *Anomalocera patersoni* occurred in the gathering from 15 fathoms, while *Pseudocalanus* formed about 2 per cent. and *Acartia clausi* 5 per cent. of those from 30 and 45 fathoms.

October.—The gatherings collected in October were similar to those just described, and the quantity of each catch did not differ to any great extent, so that, apparently, the number and general distribution of the pelagic crustacea remained much the same as it was in September. The gatherings consisted chiefly of *Calanus*, but a few *Euchæta* and *Nyctiphanes norvegicus* occurred in the hauls from 60 and 75 fathoms, and there were also a few Sagitta in some of the gatherings.

1907.

April.—Five vertical hauls were collected in April 1907. They were very small, and the total catch scarcely measured 6 c.c.'s. The contents of the various gatherings consisted for the most part of *Calanus*, but the following species were also represented, though very sparingly, viz.:—*Acartia clausi*, *Anomalocera patersoni*, *Centropages hamatus*, *Euchæta norvegica*, *Pseudocalanus elongatus*, and *Temora longicornis*. A few larval Balani, Sagitta, and fish ova were observed.

May.—The gatherings collected in May, when compared with the April collections, showed a considerable increase in the number of pelagic crustacea at this station; there was also, apparently, a fairly uniform distribution of these organisms at the various depths at which the hauls were made. The gatherings were, as usual, from 15, 30, 45, 60, and 75 fathoms, and measured respectively 27, 17, 23, 29, and 42 c.c.'s. The contents of the several gatherings consisted mainly of *Calanus*, but a few other species were observed, and also some larval Decapoda and Sagitta; these were, however, only sparingly represented.

SEPTEMBER.—The next series of gatherings from this station were collected in September. They consisted almost entirely of *Calanus*, which appeared to be very unevenly distributed. The haul from 15 fathoms measured less than 1 c.c., and that from 30 fathoms only 1·5 c.c.'s, while the other three measured respectively 21, 80, and 170 c.c.'s. These two deep-water hauls are larger than any of the others from this station collected at the same depths.

OCTOBER.—The October gatherings, from 15, 30, and 45 fathoms, were nearly blank, as also were those from 60 and 75 fathoms. They contained only a small number of *Calanus*, a few *Pseudocalanus* and *Acartia*, and one or two other common forms.

1908.

JUNE.—The series of gatherings collected in June 1908 appeared to indicate that the pelagic crustacea at this station were somewhat similar in numbers and distribution to what they were during the same month both in 1905 and 1906, as shown by the gatherings then collected. No doubt certain differences are revealed when the figures given below are compared with those for the years mentioned, but the changes noticed may easily be accounted for by local movements among the pelagic forms referred to. The present gatherings were from 15, 30, 45, 60, and 80 fathoms, and measured respectively 6·5, 10, 11, 22·5, and 41 c.c.'s.

AUGUST.—The August gatherings, compared with those collected in June, showed that in the interval a considerable falling off in the number of pelagic organisms had apparently taken place. The hauls from 15 and 30 fathoms measured each 3·5 c.c.'s, that from 45 fathoms measured 6·5 c.c.'s, and that from 60 fathoms 19 c.c.'s. The bottom gathering measured only 10 c.c.'s.

STATION II. (BETWEEN MAOL DUBH POINT AND KILFINAN BAY).

About one hundred gatherings were collected at this station during the four years. Twenty-nine were collected in 1905, nineteen in 1906, twenty-nine in 1907, and twenty-three in 1908, and are briefly described below.

1905.

JANUARY.—Four vertical hauls were collected in January—one from 15, 30, and 50 fathoms, and one from the bottom. They showed that though pelagic crustacea were apparently scarce towards the surface they were fairly plentiful near the bottom. The gathering from 15 fathoms measured less than 1 c.c., and that from 30 fathoms about 5·5 c.c.'s, while the other two measured respectively 11 and 60 c.c.'s. The four horizontal hauls collected at the same time, though larger in quantity, indicate a somewhat similar distribution of pelagic organisms to that described. A gathering taken at the surface measured 2 5 c.c.'s; others collected at 15 and 45 fathoms and near the bottom measured respectively 120, 162, and 192 c.c.'s.

MARCH.—Pelagic crustacea were apparently very scarce in March, Two hauls from 45 and 60 fathoms contained only a few *Calanus* and *Euchœta* and one or two *Nyctiphanes.* A third haul from near the bottom yielded a few demersal Copepods and one or two specimens of a small Isopod (*Pseudotanais forcipatus*).

April.—The gatherings collected in April were also small. Vertical hauls from 15, 30, 45, and 68 fathoms measured altogether only about 2 or 3 c.c.'s of pelagic crustacea, consisting chiefly of *Calanus*, but a few other Copepoda were also sparingly represented. A horizontal mid-water gathering gave rather better results, though at the same time showing that pelagic crustacea were still scarce.

May.—Vertical hauls from 15, 30, 45, 60, and 75 fathoms were collected in May, and showed a moderate increase in the number of pelagic crustacea over the April gatherings. They were distributed as follows:—2·25 c.c.'s from 15 fathoms, 4·5 c.c.'s from 30 fathoms, 4 c.c.'s from 45 fathoms, 8 c.c.'s from 60 fathoms, and the same from 70 fathoms. Horizontal hauls were also collected—one at the surface, one near the bottom, and a mid-water haul. The surface gathering measured 5 c.c.'s, that from mid-water 3·5, and that from the bottom 23·5 c.c.'s. The contents of the various hauls consisted for the most part of *Calanus*, but some other species were also represented by a fair number of specimens, *i.e.*, *Acartia clausi*, *Anomalocera patersoni*, *Centropages hamatus*, *Pseudocalanus elongatus* and *Temora longicornis.* A few *Euchœta* were observed in one of the bottom gatherings. Oikopleura were also occasionally noticed and were moderately common in the vertical haul from 30 fathoms.

August.—Vertical hauls from 15, 30, 45, and 60 fathoms were collected in August. The first two measured respectively 1 and 2 c.c.'s, and the others 8 and 12·5 c.c.'s. These gatherings consisted chiefly of *Calanus*, but a few other common forms, including *Euchœta* and Sagitta, were also present.

1906.

June.—Vertical hauls from 15, 30, 45, and 62 fathoms collected in June measured respectively 7, 5·5, 7, and 10·5 c.c.'s. The contents consisted almost entirely of *Calanus*, the only other species noticed, and which were only sparingly represented, being *Pseudocalanus elongatus*, *Metridia lucens*, and *Acartia clausi*, and a few Sagitta.

August.—The gatherings collected in August from 15, 30, 45, 60, and 75 fathoms measured respectively 1, 3·5, 20, 37, and 30 c.c.'s. In the gatherings from 15 and 30 fathoms, *Calanus* was less plentiful than in the others, while *Pseudocalanus*, on the other hand, formed nearly 70 per cent. of the catch. *Centropages hamatus* and *Parapontella brevicornis* were also observed in this sample. The other gatherings consisted almost entirely of *Calanus*, with a few *Euchœta* and *Rhoda raschi.*

September.—The series of gatherings collected in September was similar to that for August, but the catches were much smaller; those from 15 and 30 fathoms measured less than 1 c.c. each. A gathering from 50 fathoms measured 1·5 c.c.'s, while other two from 60 and 75 fathoms measured 2·5 and 20 c.c.'s respectively. These gatherings consisted almost entirely of *Calanus*, but a few *Euchœta* and *Rhoda raschi* occurred in those from 60 and 75 fathoms.

October.—The gatherings collected in October showed pelagic crustacea to be still scarce at this station except near the bottom. Hauls taken at 30 and 45 fathoms measured less than 1 c.c., and consisted of a small number of *Calanus*, *Pseudocalanus*, *Acartia clausi*, and Sagitta, while two others taken at 60 and 75 fathoms measured respectively 3·5 and 23 c.c.'s, and contained, in addition to the usual Copepoda, a number of Schizopods (including *Rhoda raschi* and *Nyctiphanes norvegicus*) and Sagitta.

1907.

April.—The five hauls collected in April 1907 were all of them small; the two largest measured only about 2 c.c.'s each. The scarcity of pelagic crustacea at this time appeared to be general all through the water, as shown by the smallness of the catches. These gatherings consisted for the most part of *Calanus*; a small number of *Pseudocalanus*, *Centropages hamatus*, and Cirriped larvæ, one or two *Nyctiphanes*, Sagitta, and fish ova were also present.

May.—The number of hauls collected in May was similar to the last. They showed that a considerable increase in the number of pelagic crustacea had taken place since the April gatherings were collected. All the catches were of moderate size, especially those taken at 45 and 60 fathoms, which measured respectively 12 and 17 c.c.'s. The other three gatherings from 15, 30, and 75 fathoms were smaller, and measured 8, 7, and 9 c.c.'s respectively. The contents of the several gatherings consisted chiefly of *Calanus*, other forms being very scarce.

June.—Moderately large gatherings were obtained in all the five hauls collected in June, but at this time pelagic crustacea were apparently more plentiful at 15 fathoms than they were lower down, as shown by the results of the different hauls, the measurements of which are as follow: —The gathering from 15 fathoms measured 80 c.c.'s, while the others from 30, 45, and 60 fathoms and the bottom measured respectively 55, 15, 22, and 25 c.c.'s.

September.—The four vertical hauls collected at this station in September exhibited a decided falling off in the numbers of pelagic crustacea when compared with those collected in June. The hauls from 15, 30, and 45 fathoms were small, and measured respectively only 1, 1·5, and 4·5 c.c.'s, while that from 65 fathoms measured 21 c.c.'s; this gathering consisted almost entirely of *Calanus*, but in those from 15 and 30 fathoms a few other species were also sparingly observed, including *Pseudocalanus*, *Centropages hamatus*, *Temora longicornis*, and *Acartia clausi*.

October.—Five vertical hauls were collected in October. Those from 15, 30, and 45 fathoms were very small, so also was the gathering from 60 fathoms. The gathering from 75 fathoms was considerably larger than the others and measured 40 c.c.'s, and though *Calanus* formed the largest part of it, a small number of *Pseudocalanus*, *Acartia*, *Nyctiphanes*, and *Rhoda raschi* were also observed. The other gatherings consisted almost entirely of *Calanus*, but among them were a few Sagitta.

December.—The gatherings collected in December were, with the exception of the haul from 15 fathoms, considerably larger than those collected in October. The gathering from 15 fathoms measured 4 c.c.'s, but those from 30, 45, and 55 fathoms measured respectively 25, 82, and 115 c.c.'s. These gatherings consisted almost entirely of *Calanus*, except that a few *Euchæta* and one or two *Nyctiphanes* were present in the haul from 55 fathoms.

1908.

March.—Vertical hauls from 30, 45 and 60 fathoms collected in March 1908 measured 2, 1, and 1·5 c.c.'s respectively. *Calanus* was the only species observed in the first two, but in the other a few *Nyctiphanes* were also noticed, as well as one or two Sagitta.

May.—The four gatherings collected in May gave fairly good results, and indicated the presence of a considerable abundance of pelagic crustacea. The hauls were from 15, 30, 45, and 60 fathoms, and measured respectively 10, 9, 31, and 17 c.c.'s. *Calanus* appeared to be the only species represented in these gatherings, with the exception of a few *Centropages hamatus* and Sagitta.

June.—Five hauls were collected in June at the usual depths; they showed that pelagic crustacea were still fairly common, but scarcely so plentiful as in the previous month. The gatherings measured respectively 5·5, 9·5, 11·5, 14·5, and 15·5 c.c.'s, and indicated a fairly uniform distribution of the organisms mentioned.

August.—The gatherings (four in number) collected in August, compared with those for May and June, showed a large falling off in the numbers of pelagic crustacea all through the water, the quantity of each of the four hauls being respectively 2·5, 2, 3·5, and 6·5 c.c.'s.

December.—The gatherings collected in December comprised vertical hauls from 15, 30, 45, 60, and 70 fathoms, and their contents measured respectively 5, 11, 47, 63, and 40 c.c.'s. They show a considerable increase over the August gatherings. In these gatherings *Calanus* was the only species observed.

STATION III., UPPER LOCH FYNE (FULLY 1 MILE S.E. FROM NORTH KAMES).

The number of gatherings collected at this station was sixty-eight. Of these, thirty-one were collected in 1905, ten in 1906, eleven in 1907, and sixteen in 1908, and are briefly described below.

1905.

January.—Two gatherings collected in January—one from 15 fathoms and one from the bottom—were very small; that from the bottom measured only 2·5 c.c.'s, the contents consisting entirely of *Calanus*.

March.—The gatherings collected in March comprised three horizontal and three vertical hauls. The horizontal gatherings were collected at the surface, mid-water, and bottom, and measured respectively 2, 4·5, and ·75 c.c.'s. Two of the vertical hauls were from the bottom and the other from 15 fathoms; they were small gatherings, and consisted for the most part of *Calanus*; but a few other forms also occurred, including *Acartia clausi*, *Diaixis pygmæus*, Decapod larvæ, and fish ova. The horizontal consisted chiefly of *Calanus*, with a few *Pseudocalanus*, *Centropages hamatus*, *Acartia clausi*, *Evadne nordmanni*, larval and young crustacea, and Sagitta.

April.—Six gatherings collected in April comprised three horizontal and three vertical hauls. The horizontal hauls were from the surface, mid-water, and bottom, and measured about 3, 1·5, and 16·5 c.c.'s respectively. One of the vertical hauls was from 15 fathoms and the other two from the bottom (28 to 30 fathoms). The first measured 2·5 c.c.'s, and the other two together about 8·5 c.c.'s (3·5 and 5 c.c.'s). Though *Calanus* was the most common species, *Centropages hamatus* was also frequent, so also was *Pseudocalanus*. In one of the bottom gatherings, for every 100 *Calanus* there were about 35 *Centropages* and 15 *Pseudocalanus*, a few *Acartia clausi*, *Euchæta*, *Evadne nordmanni*, Decapod larvæ and Sagitta and a few fish ova.

May.—The gatherings collected in May comprised one surface and three vertical hauls. They were small gatherings; the total catch measured scarcely 4 c.c.'s, of which *Pseudocalanus* formed about 4 per cent., *Centropages* 10 per cent., and *Calanus* only about 8 per cent. *Temora longicornis*, *Acartia clausi*, and *Podon leuckarti* were also sparingly represented. Oikopleura was frequent in the surface gathering, but not in the others.

June.—Two gatherings collected in June included a surface haul and a vertical haul from the bottom. They were both small and measured about 1·5 c.c.'s each. *Centropages* and *Pseudocalanus* were about equally numerous, and together formed about 70 per cent. of the entire catch.

Calanus, on the other hand, formed only about 25 per cent.; there were also a few *Temora longicornis* and some larval forms.

August.—Vertical hauls from 10, 15, and 25 fathoms were collected in August; all the three gatherings were small. About half of the total catch consisted of *Calanus* and the remainder of *Pseudocalanus*, *Centropages hamatus*, and *Acartia clausi*, but a few *Evadne*, *Podon leuckarti*, and *Parapontella brevicornis* were also observed, along with a few larval forms.

September.—Two vertical hauls, one from 15 and the other from 25 fathoms, were collected in September. The total catch measured only about 1·5 c.c.'s. The gatherings were about equal, and consisted almost entirely of *Calanus*, a few *Pseudocalanus* and *Acartia clausi* being the only other organisms observed.

October.—Two gatherings collected in October were also very small. They were vertical hauls, one from 15 fathoms and the other from the bottom, and consisted almost entirely of *Calanus*.

1906.

April.—Vertical hauls from 15 and 26 fathoms were collected in April 1906. They were both small, and together measured only about 4 c.c's. The contents of the first consisted chiefly of *Calanus*, with a few *Pseudocalanus*, *Centropages hamatus*, and a small number of fish ova. In the second gathering, *Pseudocalanus* was rather more frequent and formed about a third of the catch.

June.—Two gatherings collected in June 1906, comprising a vertical haul from 15 fathoms, and one from the bottom (about 25 fathoms), measured 3·5 and 4·5 c.c.'s respectively, and consisted almost entirely of *Calanus*.

August.—Two vertical hauls similar to the last were collected in August; one measured 3 and the other 2·5 c.c.'s. In the first *Calanus* formed fully 50 per cent. of the catch, *Pseudocalanus* 25 per cent., and *Centropages* about 20 per cent. A few specimens of *Parapontella brevicornis* and *Thaumaleus rigidus* were observed in this haul. In the bottom gathering *Calanus*, *Pseudocalanus*, and *Centropages* were about equally numerous. *Acartia clausi* was also observed, but only in small numbers.

September.—The two vertical hauls collected in September were very small, and together measured only about 2 c.c.'s. They consisted for the most part of *Calanus* and *Pseudocalanus* in nearly equal numbers. A few *Centropages hamatus* were also present in the bottom gathering.

October.—Vertical hauls from 15 and 25 fathoms were also collected in October; they were both small gatherings. In the first *Calanus* and *Acartia clausi* were about equally numerous, but a few specimens of *Anomalocera* and Decapod larvæ were also noticed. The second consisted for the most part of *Calanus*, *Pseudocalanus*, and *Acartia clausi*, together with a few *Centropages hamatus*. There were also a small number of Sagitta and Decapod larvæ present in this gathering.

1907.

April.—Two vertical hauls, one from 15 and the other from 29 fathoms, were collected in April 1907. Both gatherings were very small, and consisted chiefly of *Calanus*, mixed up with which were a few other common forms.

May.—The two vertical hauls collected in May, the one from 15 and the other from 27 fathoms, showed a marked difference from the previous gatherings in the larger amount of pelagic crustacea captured. But the two samples, which measured respectively 11 and 13 c.c.'s, consisted almost entirely of *Calanus*, no other species being noticed.

June.—The two hauls collected in June were also moderately large, but the gathering from 15 fathoms was rather smaller, and that from the bottom somewhat larger than those collected in May.

September.—The gatherings collected in September were both small and measured respectively 1·5 and 2 c.c.'s. They both consisted for the most part of *Calanus*, together with a few *Pseudocalanus*, *Centropages hamatus*, and *Acartia clausi*. A few *Evadne nordmanni* were also observed.

October.—A vertical haul from near the bottom, collected in October, yielded only a few *Calanus*, one or two *Anomalocera patersoni*, and a few Sagitta.

December.—A vertical haul from 15 fathoms, collected in December, contained only a few *Calanus*. One from 22 fathoms was also small, though slightly larger than the other. Pelagic crustacea were apparently very scarce at this station when these gatherings were collected.

1908.

February.—Two vertical hauls, one from 15 fathoms, the other from the bottom, were collected in February 1908. They each measured about 3·5 c.c.'s, and consisted almost entirely of *Calanus*, a few fish ova being also present.

March.—A haul from 15 fathoms and one from 25 fathoms, collected in March, measured respectively 2 and 3 c.c.'s. Both gatherings consisted almost entirely of *Calanus*, a few larval crustacea and fish ova being also observed.

May.—The gatherings collected in May showed a considerable increase in the number of pelagic crustacea. The hauls were vertical, from 15 and 25 fathoms, and measured respectively about 7·5 and 9·5 c.c.'s. They consisted chiefly of *Calanus*. Some other species sparingly represented included *Anomalocera*, *Centropages hamatus*, *Parapontella*, and *Podon leuckarti*. A few young Decapods and Schizopods were also noticed.

June.—The June gatherings were both small, especially that from 15 fathoms, which measured only 1·5 c.c.'s; the bottom haul was rather larger and measured about 5 c.c.'s. These samples, compared with those collected in May, seemed to indicate a falling off in the numbers of pelagic crustacea.

August.—The gatherings collected in August were even smaller than those collected in June, and though that from the bottom was slightly larger than the other, the combined catch measured less than 3 c.c.'s, and showed a further decrease in the number of pelagic crustacea.

September and November.—The gatherings collected in September and November were all blank or nearly so. The gathering from 30 fathoms collected in September contained only a few *Calanus* and *Acartia clausi*, scarcely a dozen specimens altogether, and the others were equally unproductive.

December.—The December gatherings yielded rather better results than those just referred to. The haul from 15 fathoms collected at this time measured 8 c.c.'s, and consisted entirely of *Calanus*. The other, from 30 fathoms, measured 11 c.c.'s; its contents differed from the gathering from 15 fathoms in that it contained a few *Euchæta* and Sagitta in addition to the *Calanus*.

Station IV. (about ¾-mile S.E. from Kilmichael Beg).

Thirty gatherings (including horizontal) were collected at this station in 1905, ten in 1906, twelve in 1907, and nine in 1908, and are briefly described below.

1905.

February.—Four gatherings, comprising two horizontal and two vertical hauls, were collected at this station in February 1905. One of the horizontal hauls was taken at the surface and the other at the bottom, and measured respectively 25 and 14 c.c.'s. Both gatherings consisted for the most part of *Calanus*, but in the surface hauls the following species were also met with :—*Euchæta norvegica*, *Pseudocalanus elongatus*, and *Oithona similis*; a few Decapod larvæ and fish ova also occurred. The species observed in the bottom haul included *Bradyidius armatus*, *Euchæta*, *Acartia clausi*, *Ephimedia obesa*, *Epimeria cornigera*, *Paratylus bispinosus*, *Nyctiphanes*, and *Mysis* sp.

The vertical haul from 15 fathoms consisted almost entirely of *Calanus*, and that from 28 fathoms was somewhat the same, except that a few species similar to those already referred to were also observed. The two vertical hauls were about equal, and each measured 2·5 c.c.'s. The quantities of these gatherings, both the horizontal and the vertical hauls, seemed to indicate that pelagic crustacea were rather more plentiful in the upper strata than they were near the bottom.

March.—Seven gatherings were collected in March; three of them were horizontal and four were vertical hauls. The horizontal hauls included a surface, a mid-water, and a bottom gathering, and measured respectively 6, 10, and 30 c.c.'s, and they consisted almost entirely of *Calanus*. The vertical hauls comprised two from 15 fathoms and two from the bottom. The first two were very small; the other two, though slightly larger, were also small, and together measured less than 2 c.c.'s, and consisted chiefly of *Calanus*. A small number of *Pseudocalanus* were also observed in the bottom gatherings.

April.—Three horizontal and two vertical hauls were collected at this station in April. The horizontals included a surface, mid-water, and bottom gathering, and measured respectively 5, 17, and 3 c.c.'s. The contents of the first two consisted chiefly of *Calanus*, but *Centropages* also occurred in both and formed about 5 per cent. of the combined catch. One or two other common forms were also observed in these hauls. In the bottom haul *Calanus* and *Centropages* were equally numerous, and together formed about 70 per cent. of the gathering, and *Pseudocalanus* about 15 per cent.

Both the vertical hauls were small, and only measured 1·5 and 1 c.c. respectively. The contents of these gatherings were similar in variety and proportion to that of the horizontal bottom haul.

May.—The gatherings collected at this station in May comprised two horizontal and four vertical hauls. The horizontal gatherings were both small; one was from the surface and the other from the bottom. The vertical hauls included two from 15 fathoms and two from the bottom; all the catches were small, and did not differ greatly as to quantity. The total catch did not exceed 4 c.c.'s. The gatherings consisted chiefly of *Calanus*; other species sparingly met with included *Pseudocalanus*, *Centropages*, *Parapontella*, *Temora*, *Acartia clausi*, *Evadne*, and *Podon leuckarti*.

June.—Pelagic crustacea appeared to be scarce at this station in June. Two vertical hauls, one from 15 fathoms and one from 25 fathoms, measured less than ·5 c.c. each. The most common species was *Centropages hamatus*, but *Calanus* and *Pseudocalanus* in about equal numbers also formed a considerable portion of the catch. A few *Temora*, *Acartia clausi*, Sagitta, and Decapod larvæ were also observed.

August.—Pelagic crustacea, though still apparently scarce, were rather more numerous than in June. The variety and proportional numbers of the species taken in the two hauls from 15 and 28 fathoms were, however, somewhat similar to those obtained in the June gatherings.

September.—Two vertical hauls, one from 15 and the other from 25 fathoms, collected in September, measured about 1·5 c.c.'s each, and consisted chiefly of *Calanus*, and were otherwise similar to those previously described.

October.—The two gatherings collected in October under conditions similar to the last measured less than 1 c.c. each, and contained only a small number of *Calanus, Pseudocalanus, Acartia*, and Sagitta.

1906.

April.—The two vertical hauls collected in April 1906 were small and contained a small number of *Calanus*, along with a few other common species similar to those already recorded.

June.—The gatherings collected in June showed a moderate increase in the number of pelagic crustacea at this station. The gathering from 15 fathoms measured about 3 c.c.'s, and that from 25 fathoms 6 c.c.'s. The first gathering consisted almost entirely of *Calanus*, and the same species formed about 75 per cent. of the other. A few common forms similar to those already recorded were in the bottom gathering.

August.—The August gatherings were smaller than those collected in June. In that from 15 fathoms *Calanus, Pseudocalanus*, and *Centropages hamatus* were each equally numerous, and formed about 25 per cent. of the haul. *Temora* formed about 10 per cent., and *Acartia clausi* nearly the same. A few *Anomalocera* and Decapod larvæ were also observed. The bottom gathering contained a larger proportion of *Calanus*, but otherwise it was similar to the last.

September and October.—The gatherings collected in September and October were very small, pelagic crustacea being apparently scarce during these months. The species represented were similar to those already described from this station.

1907.

April.—The vertical hauls from 15 and 28 fathoms collected in April 1907 measured respectively 1·3 and 3·5 c.c.'s, and consisted for the most part of *Calanus*.

May.—Pelagic crustacea, especially *Calanus*, were apparently fairly plentiful at this station in May 1907. A vertical haul from 15 fathoms measured 10 and one from 29 fathoms 11 c.c.'s respectively; both consisted chiefly of *Calanus*, but in the bottom gathering a number of *Pseudocalanus* and *Centropages hamatus* were also present, the one forming about 5 per cent. and the other 10 per cent. of the catch.

June.—Two gatherings were collected in June, both of which were small. That from 15 fathoms measured only 1 c.c., while the other from 26 fathoms measured 3 c.c.'s. Both gatherings consisted chiefly of *Calanus*.

September.—Gatherings from 15 and 28 fathoms were collected in September; they each measured about 2·5 c.c.'s, and, like the June gatherings, consisted for the most part of *Calanus*.

October and December.—Very small gatherings were obtained at this station both in October and December, and in each case *Calanus* formed the largest portion of their contents. A few other species occurred very sparingly, such as *Bradyidius armatus* and young *Euchœta norvegica*.

1908.

May.—Pelagic crustacea were apparently fairly plentiful at this station in May 1908, obviously due to a large increase in the number of *Calanus*.

The two vertical hauls collected at this time, one from 15 and the other from 25 fathoms, measured respectively 13 and 16 c.c.'s. The contents of both gatherings consisted chiefly of the species mentioned. *Anomalocera patersoni* and *Centropages hamatus* were also present, but they formed only about 1 per cent. of the whole catch. A small number of *Evadne nordmanni*, young Decapoda, and Schizopoda were also observed.

AUGUST AND SEPTEMBER.—The samples collected in August and September were very small, and showed a considerable decrease in the number of pelagic crustacea at this station. The contents of the various gatherings consisted almost entirely of *Calanus*.

NOVEMBER AND DECEMBER.—There was a somewhat similar absence of pelagic crustacea at this station when visited in November, but in December a distinct, though not very extensive, increase appeared to have taken place, especially in the deeper water. A vertical haul from 28 fathoms collected in December measured 2·5 c.c.'s, and consisted chiefly of *Calanus*.

STATION V. (MIDWAY BETWEEN PENNIMORE AND NEWTON BAY).

Forty-three gatherings were collected at this station in 1905, twenty-one in 1906, twenty-one in 1907, and thirty in 1908, and are briefly described below.

1905.

JANUARY.—The gatherings collected at this station in January 1905 comprised three horizontal and four vertical hauls. The horizontal gatherings collected at the surface and at 15 and 30 fathoms were all moderately large. The surface gathering measured 152 c.c.'s, and consisted almost entirely of *Calanus*. One or two other species, including *Pseudocalanus* and *Acartia clausi*, were also noticed, but they occurred very sparingly. The other two gatherings from 15 and 30 fathoms measured respectively 60 and 43 c.c.'s. The vertical hauls were from 15, 30, 45, and 59 fathoms, and measured respectively 12, 24·5, 30, and 35 c.c.'s. *Calanus* formed the largest portion of the contents of these hauls, and the quantities captured showed them to be fairly plentiful all through the water.

MARCH.—The gatherings collected in March showed that *Calanus* were still fairly abundant and more or less evenly distributed at the various depths represented by the different hauls. The four vertical hauls collected at this time were from 15, 30, 45, and 59 fathoms, and measured 18, 19, 26, and 25 c.c.'s respectively. In the haul from 59 fathoms a few *Nyctiphanes* were observed, but otherwise the contents of the different gatherings appeared to consist entirely of *Calanus*.

APRIL.—Five of the gatherings collected in April were horizontal hauls and four were vertical. One of the horizontal hauls was taken at the surface, one at 15, 30, and 45 fathoms, and one near the bottom. The surface gathering was comparatively small, but the next three were large. They measured respectively 5·5, 110, 87, and 65 c.c.'s; their contents consisted almost entirely of *Calanus*, the only other species observed being a few *Pseudocalanus*, *Centropages hamatus*, *Acartia clausi*, and a small number of Decapod larvæ. The bottom gathering contained a quantity of mud, mixed up with which were several Molluscan shells, chiefly Lamellibranchs and the undernoted crustacea—*Leptognathia brevimana H arpinia pectinata*, *Campylaspis costata*, and a few *Calanus*.

The vertical hauls were from 15, 30, 45, and 60 fathoms, and measured respectively 5, 13, 19, and 22·5 c.c.'s. The contents of these gatherings did not differ much from the others, except that in the haul from 60 fathoms there were a small number of *Nyctiphanes*, *Rhoda raschi*, and Sagitta.

MAY.—Three of the gatherings collected in May were horizontal and four were vertical hauls. The horizontal hauls included one from surface, one from mid-water, and one from the bottom. The surface and bottom hauls were both considerably larger than the other, and measured respectively 165 and 225 c.c.'s, while the mid-water gathering measured only 75 c.c.'s. The surface and mid-water hauls consisted almost entirely of *Calanus*. In the bottom haul, which was also mainly composed of *Calanus*, the following other species were observed :—*Pandalus montagui*, *Hippolyte securifrons*, *Caridion gordoni*, *Mysis lamornæ*, *Janira maculosa*, *Stegocephaloides christianiensis*, and a few *Pseudocalanus* and *Centropages* The two vertical hauls from 15 fathoms were nearly alike, and together measured about 8 c.c.'s. About three-fourths of their contents consisted of *Calanus*, the remainder being composed of *Pseudocalanus* and *Centropages hamatus*. Two gatherings from 30 fathoms differed considerably in quantity—the one measured 5 and the other 10·5 c.c.'s—and, while the larger consisted almost entirely of *Calanus*, only about a third of the contents of the smaller belonged to that species, the other two-thirds being made up of *Pseudocalanus* (chiefly), *Centropages*, and one or two other common forms. The gathering from 45 fathoms measured about 5·5 c.c.'s, and rather more than half of the contents consisted of *Calanus*, and the remainder of *Pseudocalanus* and *Centropages*.

AUGUST.—A vertical haul from 15 fathoms, which measured 1·5 c.c.'s, consisted chiefly of *Calanus*, but *Centropages hamatus* and *typicus* were also observed, the first being fairly numerous; there were also a few *Pseudocalanus* and *Acartia clausi*. Two other hauls from 30 and 45 fathoms measured respectively 3·5 and 3 c.c.'s. Both consisted mainly of *Calanus*, with which a few other other species were sparingly represented, such as *Pseudocalanus*, *Centropages hamatus*, *Euchæta*, *Bradyidius armatus*, *Temora*, *Acartia*, and *Oithona similis*, and a small number of Decapod and Isopod larvæ.

SEPTEMBER.—Four vertical hauls collected in September were from 15, 30, 45, and 60 fathoms, and measured respectively 1·5, 2, 4, and 15·5 c.c.'s. Besides *Calanus*, of which these hauls chiefly consisted, the following other species were sparingly represented, viz.:—*Pseudocalanus*, *Bradyidius*, *Euchæta*, *Acartia clausi*, *Rhoda raschi*, and a small number of Sagitta.

OCTOBER.—The gatherings collected in October comprised vertical hauls from 15, 30, 45, and 59 fathoms. These gatherings were smaller than those collected in September, and measured respectively 1, 1, 3, and 7 c.c.'s. The deep-water gathering, which, like the others, consisted mainly of *Calanus*, contained also a small number of other forms, including *Nyctiphanes*, *Rhoda raschi*, and Sagitta.

1906.

APRIL.—Vertical hauls from 15, 30, 45, and 60 fathoms collected in April 1906, measured respectively 7, 5, 16, and 12 c.c.'s. The gatherings consisted chiefly of *Calanus*, but one or two other species were observed, though only in small numbers.

JUNE.—The gatherings from this station collected in June comprised vertical hauls at 15, 30, 45, and 55 fathoms. These gatherings measured respectively 7·5, 8·5, 13·5, and 17 c.c.'s. *Calanus* formed about three-fourths of the total catch, and *Pseudocalanus* nearly one-fourth. A few *Centropages*, *Acartia*, and Sagitta were also observed.

AUGUST.—The gatherings, three in number, collected in August were from 15, 30, and 45 fathoms. They were moderately large, especially the last one, and measured respectively 11, 5·5, and 67 c.c.'s. The first consisted of *Calanus* and *Pseudocalanus* in about equal numbers; in the second *Calanus* formed about 50 per cent., *Pseudocalanus* and *Centropages hamatus*, which were nearly equal, formed together about 36 per cent., and *Acartia clausi* 14 per cent. The third haul consisted almost entirely of *Calanus*, but a small number of *Euchæta* (about 1 per cent.), and about a dozen specimens of *Rhoda raschi* and one or two *Nyctiphanes*, were also observed.

September.—Vertical hauls from 15, 30, 45, and 60 fathoms were collected in September, and measured respectively 3·5, 4, 5, and 24 c.c.'s. These gatherings, which were similar to those previously described, consisted for the most part of *Calanus*.

October.—The October gatherings were smaller than those just described. The hauls from 15 and 30 fathoms measured only 1 and 1·5 c.c.'s respectively. The others were larger, and measured, the one 5 and that from deep water 16 c.c.'s. The contents of the various hauls resembled generally those described for August.

Besides the four vertical hauls just referred to, other two horizontal gatherings were collected, one from 20 fathoms and the second from between 40 and 50 fathoms. Both of these gatherings contained a large quantity of pelagic crustacea, comprising *Calanus*, *Euchæta norvegica*, *Rhoda raschi*, and *Nyctiphanes*, this last species being abundant in the deep-water gathering, the contents of which nearly filled a large drop-jar.

1907.

April.—The only gathering from this station examined in April 1907 was from deep water, 55 to 60 fathoms, and measured 70 c.c.'s. It consisted almost entirely of *Calanus*.

May.—The gatherings collected in May 1907 were from 15, 30, 45, and 58 fathoms, and measured respectively 17, 18, 15, and 21 c.c.'s. Besides *Calanus*, which formed the largest portion of the various gatherings, there were also a fairly large number of one or two other common species. *Centropages hamatus*, for example, formed fully 5 per cent. of the haul from 15 fathoms, and about 15 per cent. of the one from 30 fathoms, and it was also represented, though somewhat sparingly, in the gathering from deep water. *Pseudocalanus* formed about 5 per cent. of the gathering from both 30 and 45 fathoms. The same species, along with *Nyctiphanes* and Sagitta, occurred also in the gathering from 58 fathoms.

June.—Moderately large hauls were also obtained in June, especially from 30 fathoms downwards. The gathering from 15 fathoms was the smallest, and measured 6 c.c.'s, but the others measured respectively 13, 15, and 15 c.c.'s. The contents of these gatherings consisted for the most part of *Calanus*.

September.—The gatherings collected in September were also moderately large, and measured respectively 9, 22, 19·5, and 90 c.c.'s. Their contents were similar to those of the June gatherings.

October.—A considerable falling off in the numbers of pelagic crustacea appears to have taken place since the previous visit to this station. The gatherings collected in October were small, especially that from 15 fathoms, which measured only 1·25 c.c.'s; the others, which were rather larger, measured respectively 6, 9·5, and 19 c.c.'s.

December.—A still further decrease was shown by the gatherings collected in December. These, with the exception of one from the deep water, only contained a small number of *Calanus* and one or two other common forms. The deep-water gathering measured 13 c.c.'s.

1908.

February.—The gatherings collected in February 1908 were moderately large, and measured respectively 9, 20, 31·5, and 55 c.c.'s. The contents of the first three consisted entirely of *Calanus*, with the exception of a few fish ova which occurred in the one from 30 fathoms. The same species also constituted the largest portion of the deep-water haul, but in this gathering a few *Rhoda raschi*, *Leptomysis gracilis*, and a small number of Sagitta were also present.

March.—Gatherings from 15, 30, and 45 fathoms collected in March measured respectively 16, 20, and 26 c.c.'s. In these gatherings *Calanus* was almost the only species observed. When compared with the February gatherings, those for March show a slight decrease in the quantity of crustacea captured.

May.—The gatherings collected in May, like those just described, consisted almost entirely of *Calanus*, which appeared to be still fairly plentiful at this station. These gatherings, taken in the same order as before, measured respectively 14, 35, 42, and 40 c.c.'s.

June.—The June gatherings were considerably smaller than those collected during the previous month, but their contents were somewhat similar. They measured respectively 3, 3·5, 6, and 12 c.c.'s.

August.—The gatherings—all vertical hauls like the others—collected in August, were large, and showed that *Calanus*, of which their contents chiefly consisted, were fairly abundant. The measurements of the various hauls, stated in the usual order, are as follow :—That from 15 fathoms measured 5·5 c.c.'s, that from 30 fathoms 18·5 c.c.'s, that from 45 fathoms 25 c.c.'s, and the bottom haul 45 c.c.'s.

September.—The four September gatherings were small. The one from 15 fathoms contained about ninety *Calanus* and five or six *Acartia clausi*; that from 30 fathoms contained 364 *Calanus*, three or four *Pseudocalanus*, and *Acartia*, while the other two from 45 and 60 fathoms measured respectively 2 and 15·5 c.c.'s, and consisted entirely of *Calanus*. A few Sagitta were observed in the gathering from 30 fathoms.

November.—Pelagic crustacea were apparently very scarce at this station in November. Three gatherings from 15, 30, and 45 fathoms contained only a small number of *Calanus* and a few other common forms.

December.—The December gatherings showed a slight increase in the number of pelagic crustacea, especially in those from 45 and 60 fathoms. These gatherings, stated in the usual order, measured respectively sm. 1, 9, 33·5 c.c.'s. *Calanus* formed the chief portion of their contents, but in the bottom gathering *Rhoda raschi* formed about 10 per cent. of the catch, which also contained a few *Euchæta* and Sagitta.

Station VI. (off Douglas Water, and distant N. by E. from Strachur 1 Mile).

About one hundred and forty-three gatherings have been collected at this station during the four years. Sixty of these were collected in 1905, twenty-five in 1906, twenty-four in 1907, and thirty-four in 1908. They are shortly described below.

1905.

January.—Eight gatherings were collected in January 1905. Three of these were horizontal and five were vertical hauls. One of the horizontal gatherings was from 15 fathoms and two from near the bottom. The first, which was comparatively small, measured 16 c.c.'s, but the other two were large and measured respectively 250 and 125 c.c.'s. The vertical hauls were from 15, 30, 46, and 60 fathoms, and one from the bottom, and measured respectively 11·5, 17, 20, 40, and 45 c.c.'s. All the gatherings, both horizontal and vertical, consisted for the most part of *Calanus*, but a number of *Euchæta norvegica* occurred in those from the deep water.

March.—The three horizontal gatherings collected in March were from the surface, mid-water, and bottom. The first was nearly blank and contained only a few *Calanus* and fish eggs. The other two, which were also comparatively small, measured about 14 and 20 c.c.'s respectively. The mid-water gathering consisted for the most part of *Calanus*, but in that from the bottom *Euchæta* were nearly as numerous as the *Calanus*. *Nyctiphanes* was also sparingly represented, as was also the somewhat rare *Campylaspis rubicunda*.

The vertical hauls were taken at intervals of about 15 fathoms, as in January, but on this occasion the hauls were duplicated, two being made at each interval. They were small gatherings, and ranged from less than 1 to 3 c.c.'s. Their contents consisted for the most part of *Calanus*.

April.—Eleven gatherings collected at this station in April yielded some interesting results. A horizontal haul taken at the surface measured only about 3 c.c.'s; one taken at about three fathoms below the surface measured 325 c.c.'s, and, like the other, consisted almost entirely of *Calanus*. The other hauls from 18, 33, 48, and 75 fathoms measured respectively 60, 3, 5·5, and 16·5 c.c.'s. The result of these hauls showed that *Calanus* was in much greater abundance near the surface than in the deep water.

The vertical hauls were taken at the same intervals as before, the last being from 75 fathoms. Their contents, which measured respectively 5·5, 4, 9, 4, and 4 c.c.'s, were similar to the hauls collected horizontally. The other species observed included *Pseudocalanus*, *Centropages hamatus*, *Acartia clausi*, and *Euchæta norvegica*, but these occurred only in small numbers.

May.—Three horizontal and four vertical hauls were collected in May. The first three included a surface, mid-water, and bottom gathering, and measured respectively 15, 24, and 60 c.c.'s. The vertical hauls were from 15, 30, 45, and 74 fathoms, and measured respectively 9, 9·5, 12, and 42 c.c.'s. These hauls show a gradual increase in the quantity of pelagic crustacea from the surface downwards. The contents of the different gatherings, like those collected in April, consisted chiefly of *Calanus*, and were otherwise similar to them.

June.—The gatherings collected in June comprised three horizontal and five vertical hauls. The surface gathering was very small and measured only 1 c.c., but the other horizontal gatherings from mid water and bottom contained a moderate quantity of pelagic crustacea, and measured respectively about 50 and 75 c.c.'s. The vertical hauls were comparatively small; they measured respectively 4·5, 7, 12, 9·5, and 14·5 c.c.'s, and consisted, like the others, almost entirely of *Calanus*.

August.—Vertical hauls from 15, 30, 45, and 60 fathoms were collected in August, and measured respectively 3·5, 5·5, 11·5, and 22·5 c.c.'s. *Calanus* was almost the only species observed in these gatherings.

September.—The gatherings collected in September were also all vertical hauls. One was taken at 15 and 30 fathoms, two at 45 fathoms, and one at 60 and another at 75 fathoms. The gatherings from 15 and 30 fathoms measured respectively 4·5, 5 c.c.'s, one of the gatherings from 45 fathoms 4·5 and the other 9 c.c.'s, while those from 60 and 75 fathoms measured respectively 75 and 125 c.c.'s. All these gatherings consisted chiefly of *Calanus*. Some other species, including *Pseudocalanus elongatus*, *Bradyidius armatus*, *Euchæta norvegica*, *Acartia clausi*, *Rhoda raschi*, *Nyctiphanes*, and Sagitta were observed, but they occurred very sparingly.

October.—Five vertical hauls were collected in October. The first three gatherings were very small, and measured respectively 1, 1, and 1·5 c.c.'s, while that from 60 fathoms measured 25 c.c.'s, and the last from 70 fathoms, 170 c.c.'s. These gatherings showed that pelagic crustacea, though apparently scarce from 15 down to 45 fathoms, were fairly abundant near the bottom. The contents of the different hauls consisted for the most part of *Calanus*, and were otherwise similar to those collected in September.

1906.

The gatherings collected in 1906 numbered 25. Five were collected in April and June, and the same number in August, September, and October. They were all vertical hauls, from 15, 30, 45, and 60 fathoms, and one from the bottom.

April.—The gatherings collected in April seemed to indicate that pelagic crustacea, though not very plentiful, were distributed more or less uniformly throughout the water. The hauls measured respectively 5, 5, 7, 11·5, and 8 c.c.'s, showing an average of about 7·3 c.c.'s for each. The contents of the different hauls consisted as usual for the most part of *Calanus*, but a few other species were also observed, comprising *Pseudocalanus*, *Euchæta* and *Acartia clausi*, three or four *Nyctiphanes*, and a small number of Sagitta.

June.—The distribution of the pelagic crustacea as shown by the June gatherings still continued fairly uniform, but there was apparently a considerable increase, especially in the number of *Calanus*, the average for the five hauls being about four times the average for April. The gatherings collected in June measured respectively 25, 22·5, 24, 35, and 40 c.c.'s. There was a slight increase in the number of *Euchæta* present in the bottom gathering, but otherwise the contents of the various hauls were similar to those collected in April.

August.—The gatherings collected in August showed that a considerable falling off in the number of pelagic crustacea had taken place since the June gatherings were collected, and that their distribution was much less uniform. The hauls from 15 and 30 fathoms were similar in quantity, and measured only 3·5 c.c.'s each, those from 45 and 60 fathoms measured respectively 19 and 17·5 c.c.'s, while that from the bottom measured 70 c.c.'s. The contents of these gatherings did not differ much from those collected in June, except that *Calanus* appeared to be more immature.

September.—The September gatherings somewhat resembled those of the previous month, but *Euchæta* appeared to be rather more frequent, and in some of the hauls formed about 1 per cent. of the catch. The hauls from 15 and 30 fathoms measured respectively 2·5 and 5 c.c.'s, and that from 45 fathoms 21 c.c.'s. The next two gatherings—the one from 60 fathoms and the other from the bottom—differed considerably. The one measured only 15 while the other measured 60 c.c.'s. A few *Rhoda raschi* and *Nyctiphanes* occurred in the gatherings from deep water, and a small number of Sagitta were also observed, but *Calanus* was the predominating species in all the gatherings.

October.—The hauls collected in October from 15, 30, and 45 fathoms were small, and measured 3, 2·5, and 6 c.c.'s respectively, but those from 60 and 70 fathoms measured, the one 55 and the other 115 c.c.'s. The contents of the various hauls were similar to those collected during the previous month.

1907.

The gatherings collected in 1907 numbered twenty-four. They were all vertical hauls. Five of them were collected in April and May, four in September, and five in October and December, as described below:—

April.—The distribution of the pelagic crustacea, and especially of *Calanus*, was shown by the gatherings collected in April to be more or less uniform from 30 fathoms downwards, and also to be fairly abundant. Above 30 fathoms they were apparently scarcely so numerous. The five hauls collected at this time measured respectively 8, 16, 20, 16, and 14 c.c.'s. The last gathering, which was from 73 fathoms, contained a few *Euchæta*, *Nyctiphanes*, and Sagitta in addition to *Calanus*, which constituted the chief portion of this as well as of the other gatherings mentioned.

May.—The gatherings collected in May from 15 and 30 fathoms measured respectively 8·5 and 8 c.c.'s, while the others from 45, 60, and 73 fathoms measured 20, 25, and 18 c.c.'s. The contents of the several gatherings resembled those collected in April, except that *Euchæta* was rather more numerous in the haul from 73 fathoms, and formed about 3 per cent. of this gathering. A few specimens of *Nyctiphanes* and *Rhoda raschi* were also observed.

September.—Four gatherings were collected in September. The first three, taken at the usual depths, were comparatively small; the one from 15 and that from 30 fathoms measured 5 c.c.'s each, and the other from 45 fathoms 6 c.c.'s. But while these gatherings seemed to indicate that pelagic crustacea were not very plentiful down to 45 fathoms, that from 67 fathoms showed them to be moderately abundant towards the bottom. This gathering measured 130 c.c.'s. All the gatherings consisted for the most part of *Calanus*; *Pseudocalanus* and *Acartia clausi* occurred in small numbers (less than 1 per cent.) in the hauls from 15 and 30 fathoms, and a few specimens of *Nyctiphanes* and *Rhoda raschi* in that from 67 fathoms.

October.—The gatherings collected at this station in October showed that the tendency of the pelagic crustacea to crowd towards the bottom was even greater than in the previous month. The hauls from 15 and 30 fathoms measured only 2 c.c.'s each, and that from 45 fathoms 5 c.c.'s. The haul from 60 fathoms was also comparatively small, while a gathering from near the bottom (77 fathoms) measured 168 c.c.'s. These, like the September gatherings, consisted almost entirely of *Calanus*.

December.—The gatherings collected in December differed little from those just described, and showed a somewhat similar inequality in the distribution of the pelagic crustacea. The gatherings consisted chiefly of *Calanus*. A few other species, comprising *Euchæta norvegica*, *Rhoda raschi*, and *Nyctiphanes norvegicus*, and also Sagitta, were observed, but they occurred very sparingly.

1908.

The number of gatherings collected at this station in 1908 was thirty-four or thirty-five. Three were collected in February, four in March, and the same number in May. Five or six were collected in June, five in August, four in September, three in November, and five in December, as described below.

February.—The three gatherings collected in February were from 15, 30, and 45 fathoms, and measured respectively 20, 23, and 45 c.c.'s. The first two consisted entirely of *Calanus*, no other species being observed, while the third differed only in that it contained a few Sagitta.

March.—The gatherings collected in March comprised four hauls. The smallest gathering was that from 15 fathoms and the largest from 30 fathoms; these two measured respectively 4 and 25 c.c.'s. The other two from 45 and 60 fathoms measured, the one 17 and the other 21 c.c.'s. These gatherings, like those collected in February, consisted almost entirely of *Calanus*.

May.—Four gatherings were also collected in May. They resembled those just described in that they consisted almost entirely of *Calanus*, but the haul from 15 fathoms was rather larger than either of the next two from 30 and 45 fathoms, and was only slightly less than that from 60 fathoms, the measurements being as follows:—The haul from 15 fathoms measured 20 c.c.'s, that from 30 fathoms 18 c.c.'s, while the others from

45 and 60 fathoms measured respectively 19 and 21 c.c.'s. These gatherings showed that the distribution of *Calanus* was fairly uniform from 15 fathoms downwards.

JUNE.—The gatherings collected in June showed a moderate increase in the various catches except that from 30 fathoms, which amounted only to about two-thirds of that for May from the same depth. The gatherings from 15, 30, 45, and 60 fathoms measured respectively 29, 11, 30, and 32 c.c.'s. Two other hauls from 78 and 80 fathoms measured each 50 c.c.'s. The contents of these various hauls were similar to those previously described.

AUGUST.—The five hauls collected in August exhibited still further changes in the distribution of the pelagic crustacea, and there also appeared to be a falling off in the number of these organisms in the upper strata, and at the same time a marked increase towards the bottom of the loch. While the gatherings from 15, 30, and 45 fathoms measured respectively 6·5, 13·5, and 23·5 c.c.'s, those from 60 and 75 fathoms measured, the one 41 and the other 100 c.c.'s.

SEPTEMBER.—All the gatherings collected in September were small, showing that a considerable decrease in the number of pelagic crustacea all over the loch had taken place since the station was visited in August. The hauls, taken in the same order as before, measured respectively 2·5, 2, 3, and 6 c.c.'s, and though *Calanus* continued to be the more common species, there appeared to be a larger number of *Euchæta* present, especially in the haul from 60 fathoms. In this haul *Euchæta* formed about 1 per cent. of the gathering. A few specimens of *Pseudocalanus* were also observed, as well as a small number of Sagitta.

NOVEMBER.—Three vertical hauls were collected in November. One from 15 fathoms was nearly blank. A gathering from 45 fathoms was also small, and measured only 1 c.c. It consisted chiefly of *Calanus*, together with a small number (about 2 per cent.) of *Euchæta norvegica.* A third haul from 60 fathoms was moderately large, and measured 20 c.c.'s, and, like the others, it consisted for the most part of *Calanus.* A few *Euchæta*, *Rhoda raschi*, and a small number of Sagitta were also present.

DECEMBER.—The gatherings collected in December from 15 and 30 fathoms measured only ·5 and 1·5 c.c's., that from 45 fathoms was somewhat larger, and measured 6·5 c.c.'s. Below this pelagic crustacea were met with in considerable abundance; hauls taken at 60 and 70 fathoms measured respectively 47 and 90 c.c.'s.

OTHER GATHERINGS EXAMINED.

A few gatherings were collected in the vicinity of Skate Island in April 1905 and June 1906. The former comprised three horizontal hauls and five vertical ones, and the latter, four hauls, which were also vertical. Three vertical hauls were also taken off Minard, two in March and one in November 1908. All these gatherings, collected with the usual tow-nets, did not differ greatly in their contents from those taken in other parts of Loch Fyne.

In October 1906 several hauls were made off Inveraray and also off Newton with a large "mid-water" net, and considerable quantities of *Calanus*, *Euchæta norvegica*, *Nyctiphanes norvegicus*, and *Rhoda raschi* were captured, but with the exception of a quantity of Sagitta little else was observed in these gatherings.

The following tables show the number of vertical hauls collected at each of the six stations mentioned in the preceding notes, the year and month when collected, and the depth from which the various hauls were taken. The quantity of each haul is also stated, in most cases in cubic centimetres (c.c.'s), but some hauls which measured less than 1 c.c. are marked "sm."—small. The horizontal hauls are left out, as no such gatherings were taken after 1905.

STATION I.

B. = bottom. s.m. = gathering small—quantity less than 1 c.c.

Months when Collections were made.	1905.					1906.					1907.					1908.				
	Quantities in cubic centimeters (c.c.'s) of Vertical Hauls from					Quantities in cubic centimeters (c.c.'s) of Vertical Hauls from					Quantities in cubic centimeters (c.c.'s) of Vertical Hauls from					Quantities in cubic centimeters (c.c.'s) of Vertical Hauls from				
	15 fms.	30 fms.	45 fms.	60 fms.	B.	15 fms.	30 fms.	45 fms.	60 fms.	B.	15 fms.	30 fms.	45 fms.	60 fms.	B.	15 fms	30 fms	45 fms	60 fms	B.
February - -	...	2·5	?	2·5	*1·5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
March - -	s.m.	s.m.	s.m.	s.m.	s.m.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
April - -	2·5	5·5	2·5	2	2	s.m.	s.m.	s.m.	...	s.m.	s.m.	1·5	2	2	s.m.	...	...	...	...	...
May - -	3·5	3	3	5	7·5	...	...	...	...	...	27	17	23	29	42	...	...	...	...	...
June - -	3	11·5	20·5	25·5	55	3·5	10·5	9·5	20	25	...	...	...	...	...	6.5	10	11	22.5	41
August - -	1·5	2·5	6	50	14	3	7·5	15·5	20·5	100	Nets lost.			...	45	3·5	3·5	6·5	19	10
September -	1	1	2·5	9·5	25	1	1·5	1·5	15·5	70	s.m.	1·5	21	80	170	...	...	...	...	...
October - -	...	...	...	...	...	s.m.	s.m.	1	24·5	55	s.m.	s.m.	1	2	3·5	...	...	...	...	...

* Also a haul from 70 fms. measured 2·5 c.c.'s.

STATION II.

	1905.					1906.					1907.					1908.				
	15 fms.	30 fms.	45 fms.	60 fms.	B.	15 fms.	30 fms.	45 fms.	60 fms.	B.	15 fms.	30 fms.	45 fms.	60 fms.	B.	15 fms	30 fms	45 fms	60 fms	B.
January - -	s.m.	5·5	11	60	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
March - -	...	...	s.m.	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	1·5	...
April - -	s.m.	s.m.	s.m.	...	1	...	...	...	...	...	s.m.	1·5	1·5	2	3	...	...	...	...	...
May - -	2.25	4·5	4	8	8	...	...	...	...	...	8	7	12	17	9	10	9	31	17	...
June - -	...	...	...	...	...	7	5·5	7	10·5	...	80	55	15	22	25	5·5	9·5	11·5	14·5	15·5
August - -	1	2	8	12·5	...	1	3·5	20	37	30	...	...	...	...	...	2·5	2	3·5	6·5	...
September -	...	...	...	...	...	s.m.	s.m.	1·5	2·5	20	1	1·5	4·5	21	...	...	...	...	...	...
October - -	...	...	...	...	...	s.m.	s.m.	s.m.	3·5	23	s.m.	s.m.	1	8	40	...	...	...	...	...
December -	...	...	...	...	...	...	...	...	...	...	4	25	82	115	...	5	11	47	63	40

STATION V.

January - -	12	24·5	30	35	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
February - -	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9	20	31·5	55	...
March - -	18	19	26	25	...	...	...	...	...	...	...	...	...	...	...	16	20	26	...	...
April - -	5	13	19	22·5	...	7	5	16	12	...	...	...	...	70	...	...	...	...	...	...
May - -	†3·5 4·5	5 10·5	... 5·5	...	...	...	...	...	...	...	17	18	15	21	...	14	35	42	40	...
June - -	...	...	...	...	...	7·5	8·5	13·5	17	...	6	13	15	15	...	3	3·5	6	12	...
August - -	1·5	3·5	3	...	...	11	5·5	67	...	...	...	...	...	...	...	5·5	18·5	25·5	45	...
September -	1·5	2	4	15·5	...	3·5	4	5	24	...	9	22	19·5	90	...	s.m.	s.m.	2	15·5	...
October - -	1	1	3	7	...	1	1·5	5	16	...	1·25	6	9·5	19	...	...	...	...	...	...
November -	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	s.m.	s.m.	s.m.	...	...
December -	...	...	...	...	...	...	...	...	...	...	s.m.	1·5	1	13	...	s.m.	1	9	33·5	...

STATION VI.

January - -	11·5	17	20	40	45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
February - -	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	33	45	...	...
March - -	*1·5	†1·5 1·5	†s.m. 3	†s.m. 2·5	...	...	...	...	...	...	...	...	...	...	...	4	25	17	21	...
April - -	5·5	4	9	4	4	5	5	7	11·5	8	8	16	20	16	14	...	...	...	...	...
May - -	9	9·5	...	12	42	...	...	...	...	...	8·5	8	20	25	18	20	18	19	21	...
June - -	4·5	7	12	9·5	14·5	25	22·5	24	35	40	...	...	...	...	...	29	11	30	32	†50 50
August - -	3·5	5·5	11·5	22·5	...	3·5	3·5	19	17·5	70	...	...	...	...	...	6·5	13·5	23·5	41	100
September -	4·5	5	†4·5 9	75	125	2·5	5	21	15	60	5	5	6	...	130	2·5	2	3	6	...
October - -	1	1	1·5	25	170	3	2·5	6	55	115	2	2	5	18	168	...	...	...	...	...
November -	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	s.m.	s.m.	1	20	...
December -	...	...	...	...	...	...	...	...	...	...	1·5	2	3	62	110	s.m.	1·5	6·5	47	90

* Also a haul at 20 fms. = s.m.

† Two hauls at same time and place.

Station IV. Station III.

B. = bottom. s.m. = small—quantity less than 1 c.c.

Months when Collections were made.	Station IV. Quantities in cubic centimeters (c.c.'s) of Vertical Hauls collected in								Station III. Quantities in cubic centimeters (c.c.'s) of Vertical Hauls collected in							
	1905 from		1906 from		1907 from		1908 from		1905 from		1906 from		1907 from		1908 from	
	15 fms.	B.	15 fms.	B.	15 fms.	B.	15 fms.	B.	15 fms.	B.	15 fms.	B.	15 fms.	B.	15 fms.	B.
January	...	...	...	...	...	...	...	...	s.m.	2·5	...	...	...	...	...	...
February	2·5	2·5	...	...	...	...	...	...	...	...	...	...	...	...	3·5	3·5
March	* s.m. s.m.	*1 s.m.	...	...	...	...	...	...	s.m.	s.m.	...	...	...	...	2	3
April	* s.m. 1·5	1	s.m.	s.m.	1·5	3·5	...	...	2·5	3·5	1·5	2·5	s.m.	1·5	...	...
May	* s.m. 1	*1 1·5	...	...	10	11	13	16	s.m.	* s.m. s.m.	...	...	11	13	7·5	9·5
June	s.m.	s.m.	3	6	1	3	...	...	1·5	1·5	3·5	4·5	8	14	1·5	5
August	s.m.	1	1	1·5	2·5	2·5	s.m.	s.m.	s.m.	s.m.	3	2·5	...	...	s.m.	2
September	1·5	1·5	s.m.	s.m.	2·5	2·5	s.m.	s.m.	s.m.	1	1	1	2	1·5	s.m.	s.m.
October	s.m.	s.m.	s.m.	s.m.	1	1·5	...	...	s.m.	s.m.	s.m.	1	...	s.m.	...	...
November	...	...	...	...	...	...	s.m.	s.m.	...	...	...	...	...	...	s.m.	s.m.
December	...	...	...	...	s.m.	2·5	...	2·5	...	...	...	...	1	1·5	8	11

* Two hauls at same time and place.

List of the Species of the Crustacea obtained in the Gatherings from Loch Fyne described in the preceding Notes.

COPEPODA.

Nearly all the Copepoda observed belong to the division *Calanoida*, G. O. Sars. Two species belong to the *Harpacticoida*, one to the *Cyclopoida*, and one to the *Monstrilloida*.

CALANOIDA.

Calanus septentrionalis (Goodsir). This is the *Calanus helgolandicus* of Claus, but Goodsir's is the older name. It does not differ greatly from *C. finmarchicus* (Gunner), and perhaps should be still included in that species. It is the most common and generally distributed species in our seas, and it is also the most important, as it forms a large part of the food of the herring.

Paracalanus parvus, Claus. This small species occurred in gatherings from Stations V. and VI. and one or two other stations, but always rather sparingly.

Pseudocalanus elongatus, Boeck. This species is generally distributed, and sometimes moderately common in Loch Fyne. It occurred in most of the gatherings examined.

Bradyidius armatus, Vanhöffen. This species occurred sparingly at Stations II., V., and VI., and one or two other stations.

Euchæta norvegica, Boeck. Plentiful in large "mid-water" and "ring" net gatherings collected off Inveraray and Newton in October 1906, and more or less sparingly in gatherings collected with the ordinary tow-net, at most of the stations referred to in the preceding notes.

Diaixis pygmæus (T. Scott). Rare in a bottom gathering collected at Station IV., Upper Loch Fyne, March 1905.

Centropages typicus, Kröyer. This species appeared to be rare in Loch Fyne. The only gathering in which it was observed was in a vertical haul from 15 fathoms collected at Station II. in August 1905. Mr. W. L. Calderwood has also recorded this species from E. Loch Tarbert (Lower Loch Fyne). *15th Annual Report, Fishery Board for Scotland*, Part III., p. 146 (1897).

Centropages hamatus (Lillj.). This occurred in many of the gatherings examined, and was occasionally moderately frequent.

Temora longicornis (O. F. Müller). *Temora* was observed sparingly in gatherings from several stations, and appeared to be generally distributed.

Metridia lucens, Boeck, occurred rather sparingly in gatherings collected at Stations II., III., V., and VI., and at one or two other stations.

Anomalocera patersoni, Templ., was obtained usually in surface gatherings or in gatherings from near the surface at several stations, but always in small numbers.

Parapontella brevicornis (Lubbock). This was one of the rarer species observed. It occurred in gatherings from Stations II., III., and VI., and one or two other stations.

Acartia clausi, Giesbrecht. Hitherto this is the only species of Acartia that has been recorded from Loch Fyne. Is occurred, though somewhat sparingly, in a large proportion of the gatherings examined.

HARPACTICOIDA.

Zosime typica, Boeck. This species was observed in a gathering from Station V. in 1905.

Harpacticus uniremis, Kröyer. This species occurred in a gathering collected off Skate Island.

CYCLOPOIDA.

Oithona similis, Claus. This species was moderately rare in gatherings from Stations II. and III.

MONSTRILLOIDA.

Thaumaleus rigidus, I. C. Thompson. The only gathering in which this species was met with was one from Station IV., collected in August 1906.

AMPHIPODA.

Most of the Amphipoda recorded here occurred in bottom hauls.

Parathemisto oblivia (Kröyer) was obtained in one of the gatherings collected at Station VI. in March 1905.

Tryphosites longipes (Bate), in a bottom gathering from Station II.

Harpinia pectinata, G. O. Sars. This species was observed in gatherings both from Stations II. and V. Two of the specimens from Station V. were infested with the small crustacean parasite *Sphæronella cluthæ*, T. Scott.

Leucothoe lilljeborgi, Boeck, occurred in a gathering from Station V., collected in April 1905.

Epimeria cornigera (Fabr.).
Iphimedia obesa, Rathke.
Apherusa bispinosa (Bate).

These three species were obtained in a bottom haul from Station III., collected in February 1905.

Dexamine spinosa (Montagu) occurred in one of the gatherings collected in April 1905 at Station VI.

Stegacephaloides christianiensis (Boeck) was obtained in a gathering from Station II., collected in May 1905.

Gammarus locusta (Linné), Station V., August 1905.

ISOPODA.

Three species belonging to the Chelifera, one to the Flabellifera, and one to the Asellota were obtained in bottom gatherings, viz.:—

Leptognathia brevimana (Lilljborg). This species occurred sparingly in gatherings both from Station II. and Station V.

Leptognathia breviremis (Lilljeborg). In a gathering from Station V.; rare.

Pseudotanais forcipatus (Lilljeborg). This species was observed in gatherings from Station V., collected in March and April 1905.

Eurydice pulchra, Leach. Rare in a surface gathering collected off Inveraray in October 1906.

Janira maculosa, Leach. Station II. in May 1905.

SYMPODA.

The following species of crustacea belonging to this group have been observed in the gatherings that have been examined:—

Leucon nasicus (Kröyer). Station V., in a bottom gathering collected in April 1905.

Eudorella truncatula (Bate). This occurred in the same gathering with the last.

Diastyloides biplicata, G. O. Sars. In a bottom gathering collected in the vicinity of Station VI.

Leptostylis sp. In the same gathering with the last was a specimen of *Leptostylis* which was not satisfactorily determined, but probably belonged to *L. villosa*, G. O. Sars.

Campylaspis rubicunda, Lilljeborg. Was obtained in a bottom gathering from Station I. It has also been collected near Lowburn.

Campylaspis costata. Collected in the vicinity of Station V. in the same gathering as the *Diastyloides* mentioned above.

SCHIZOPODA.

Five species belonging to this group were observed, viz.:—

Nyctiphanes norvegica, M. Sars. Abundant in gatherings collected with large "mid-water" and "ring" nets off Inveraray and Newton in October 1906, and also, but more or less sparingly, in gatherings from Kilfinnan Bay, Barmore, Furnace, and Strachur Bays, etc.

Rhoda raschi (M. Sars). Common in the same gatherings with *Nyctiphanes* collected off Inveraray and Newton, and sparingly in gatherings from most of the stations referred to in the preceding notes.

Leptomysis gracilis, G. O. Sars. In a gathering from Station II., collected in February 1908.

Hemimysis lamornæ (R. Q. Couch). This small and brightly-coloured species was also obtained in Station II., in a gathering collected in May 1905.

Schiztomysis ornata (G. O. Sars). Station III., in a gathering collected in February 1905.

DECAPODA.

The following are a few Decapod species which were also observed in some of the gatherings. They all belong to the Caridea.

Crangon allmanni, Kinahan. Obtained in a gathering collected at Station II.

Hippolyte securifrons, Norman. Collected in Station II. in May 1905.

Caridion gordoni (Bate). Obtained in the same gathering with the last.

Pandalus montagui, Leach. This also occurred in the gathering from Station II. with the two species just recorded.

Pandalina brevirostris (Rathke). Station III., February 1905.

Pasiphœa sivado (Rizzó). This species was obtained in a gathering collected in the vicinity of Station VI. in March 1905.

Larval forms belonging both to the Decapoda and Schizopoda were also occasionally met with, but usually more or less sparingly. *Evadne nordmanni* and *Podon leuckarti* were also observed, as well as a few specimens of Ostracoda, *i.e.*, *Cytheridea papillosa* and others.

Sagittæ were also present in many of the gatherings, but usually in small numbers.

IV.—EXPERIMENTS TO SHOW THE INFLUENCE OF COLD IN RETARDING THE DEVELOPMENT OF THE EGGS OF THE HERRING (*CLUPEA HARENGUS*, L.), PLAICE (*PLEURONECTES PLATESSA*, L.), AND HADDOCK (*GADUS ÆGLEFINUS*, L.). By H. Chas. Williamson, M.A., D.Sc., F.R.S.E., Marine Laboratory, Aberdeen.

(Plate I.)

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The Government of New Zealand has requested the Fishery Board for Scotland to carry out certain experiments bearing on the retardation of the development of the ova of the herring. Information was desired as to whether it was possible to prolong the period of incubation to 50 days, an interval which would admit of the eggs being conveyed from this country to New Zealand before they hatched.

Since the period of incubation depends, within limits, on the temperature of the water, the retardation of development is a matter of maintaining the eggs at a sufficiently low temperature. I was asked by Dr. Fulton to make these experiments, and I have been able to show that the period of incubation may be extended to 50 days. Some embryos were in the egg for a longer period.

The eggs upon which the experiments were made were obtained at Anstruther in February and March 1908, during the winter herring fishing in the Firth of Forth. Since the ova of the herring are adhesive, it is convenient to have them spread on glass plates. This facilitates examination from time to time, and simplifies the arrangements for transport.

On February 17 very few herrings were being caught, and of these the majority were not yet ripe. There was, however, a proportion of them in the running condition. The herrings were being caught close inshore, where the water was too shallow to permit the large boats to drift. They were also being taken in nets anchored in three fathoms of water. When the herrings are so ripe that the eggs and milt run freely from them they are termed locally "maisie herrings."

With the courteous assistance of Mr. W. Keir, Fishery Officer, Anstruther, arrangements were made whereby the skippers* of certain boats kindly agreed to try to bring a few herrings ashore alive. For this purpose herring barrels were employed. A small hole was bored in the side of the barrel near the bottom; it was closed with a peg, and was intended as an outlet for the bottom water when the water was being freshened. Some live ripe herrings were got in this way, and from them I obtained a sufficient supply of spawn. Spawn was also taken from some dead herrings.

The method in which the artificial fertilization was carried out was that described by Ewart.† The milt was pressed out into the water in a tub. A female herring was then taken into the tub. A glass plate, 9 inches square, was held below the fish to receive the eggs as they were pressed out in a narrow ribbon. The ova were distributed as well as possible over the plate, although the struggles of the fish interfered to prevent this being always satisfactorily accomplished, the movements of the tail occasionally scattering the eggs. The eggs adhered to the plate immediately on contact. There were often some scales attached to the eggs. Where the eggs were taken from fishes that had been several hours dead the plates were more liberally sprinkled with scales than in those cases where the fishes were alive.

The number of herrings brought back in the barrel was usually about ten, and as a rule the majority were dead on the arrival of the boat; they had been from six to eight hours in the barrel. It was found that the herrings which survived were ripe, those in which the ova and milt ran out on gentle pressure. The females having large hard roes succumbed more readily.

The glass plates with the ova adhering to them were allowed to stand for from one to seven hours in the tub among the water containing the milt. They were contained in wooden cases, each of which held six or more plates. For transport to Aberdeen the cases were put into barrels filled with sea water. The cases floated. The barrel was headed up after being filled completely.

There was a certain amount of doubt as to how long it was safe to leave the eggs in the tub in which there was an excess of milt. It is probable that fertilization is completed in a comparatively short time, *e.g.*, within three or four hours. Brook noted the evidence of fertilization in the formation of the perivitelline space in one case half an hour after the mixing of the sperm and ova. Probably the only danger which might be expected to threaten the eggs would be from the decay of the unused milt. At this time the weather was very cold, and it is probable the danger was not a very near one.

Six lots of spawn were got in all, viz.:—

I. The first lot of spawn was obtained on the morning of 18th February. The herrings were dead, but they had been alive just a short time previously. The milt flowed out freely on pressure in a rather coherent form. The eggs were fertilized at 2 a.m., and the plates were left in the tub till 10 a.m. They were then transferred to the barrel and sent to Aberdeen. They were unpacked at the Laboratory and put into running water at 7 p.m. They had been nine hours in the barrel.

II. The eggs of this lot were obtained on the afternoon of February 18 from both live and dead herrings; the milt was supplied by live males. The plates stood in the original water in which the eggs and milt were spawned for three-and-a-half hours. Some plates were filled with ova, and fertilization was attempted with maisie herrings of both sexes that had been dead for six hours. The later history of this lot is not known, as they became mixed with the preceding plates of Lot II.

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* Messrs. M'Kay, T. and J. Birrel, Anstruther; J. Paton, Montrose; and Smith, St. Monance.

† Ewart—"Natural History of the Herring." *Second Annual Report of the Fishery Board for Scotland* for 1883. Edinburgh, 1884. P. 71.

The barrel containing the cases was headed up at 6 p.m., and it was unpacked in the Laboratory 19 hours later. The water had been unchanged during that period.

III. The third lot of eggs was got at mid-day on February 19 from two live herrings, a female 25 cm. long and a male 28·8 cm. in length. The milt was squeezed out in a coherent ribbon. Three plates were filled. The plates were allowed to remain for one hour before they were packed in the barrel. Some of the milty water was put into the barrel. The barrel was unpacked 7½ hours later.

IV. Spawn was obtained at St. Monance at 1.30 a.m. on February 28 from live and dead females. The milt was obtained from live herrings. Both the milt and the eggs ran more freely than during the operations a week previously. The barrel was packed at 7.30 a.m., and unpacked at Aberdeen seven hours later, or 13 hours after fertilization. The water had only been changed once, that was when the barrel was packed.

V. The fifth lot of spawn was among gravel. A thick layer of gravel was put into a barrel, which was taken to sea in a fishing boat. The spawning was carried out by one of the crew. The milt was pressed out of a living male herring into a bucket of water. The living females were pressed in the barrel of water. Some milt was added from the bucket with each female spawned. An attempt was made to distribute the spawn over the gravel. The eggs falling to the bottom became attached to the gravel and formed big masses of eggs stuck together, or remained unattached single eggs. The eggs were spawned between 4 a.m. and 5 a.m. on March 5th, and the consignment arrived at the Laboratory about 9 p.m. on that day.

As the weather was cold at this time, no arrangements were necessary in the case of any of the consignments to guard against any possible rise in temperature during the journey.

It is important at all stages to have good clean water for the eggs. Mud sticks closely. It may sometimes be removed partially by means of a brush or a little jet of water.

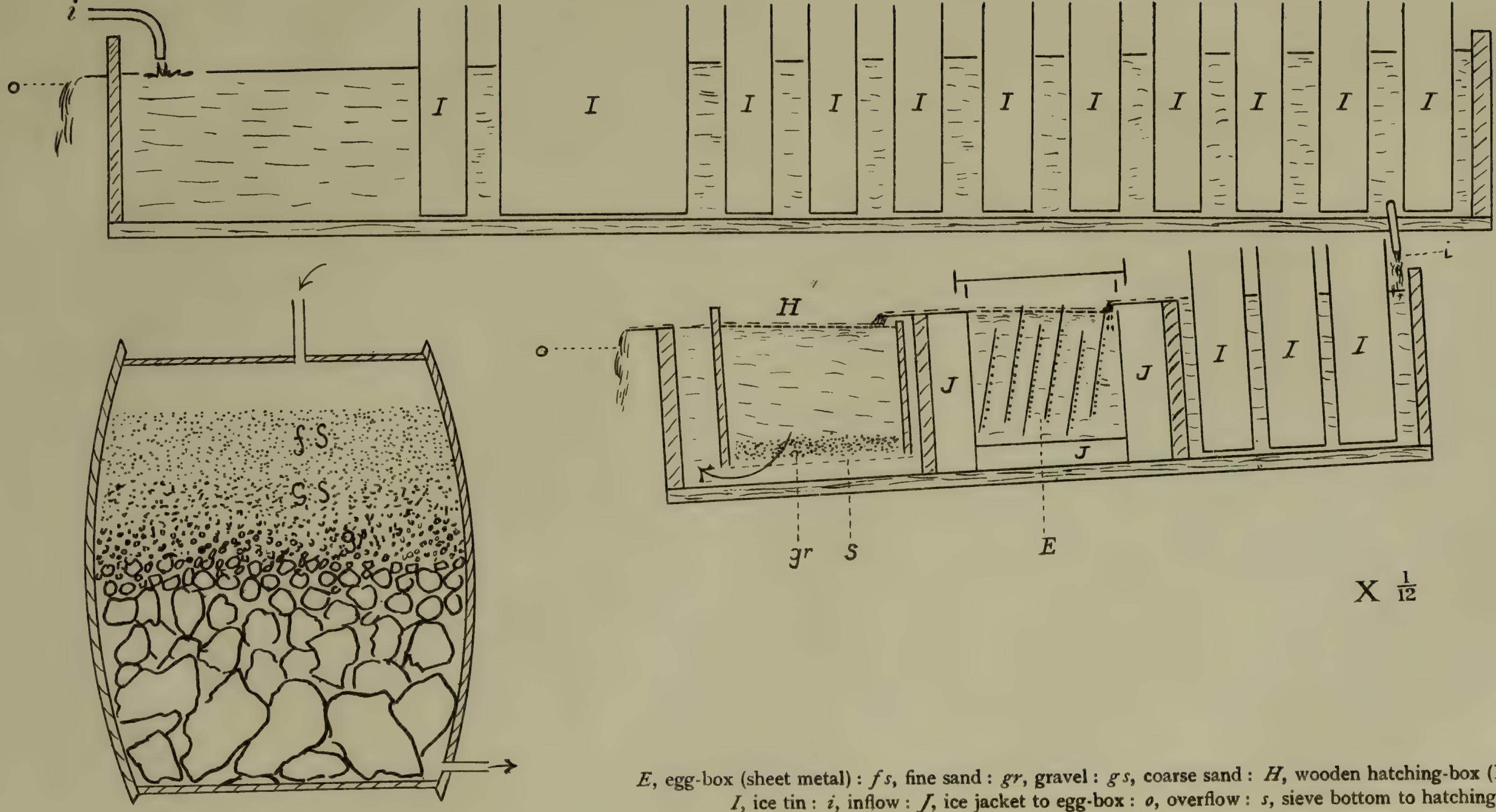
In transferring the plates of eggs from one receptacle to another, and also, later, when examining the eggs, it was necessary to expose them temporarily to the air. This is probably a disadvantage, although no harm was clearly traced directly to this cause. Every plate has been in this way exposed to the air. In future arrangements this should be avoided.

The sixth lot of spawn was obtained in September. It was, like the last, mixed with gravel. The barrel was forwarded without any cooling arrangements. It arrived on September 12th. On that date the temperature of the air was at one time 15·2° C.

On arrival at the Laboratory the eggs were not, as a rule, transferred directly to the cooled water. They were usually left a night in the wooden cases in running water. Then they were distributed in the cooled boxes, or in water of the ordinary temperature. The water supplied to the hatchery at this time of the year was cold, sometimes being below 4° C. On February 28, 29, and March 1, the temperature of the water on each date fell to between 2° and 3° C.

The spawn on the glass plates was at first put into the egg-boxes (E, in the accompanying wood-cut). The glass plates are there shown inclined in position, with the eggs on the under side.

The water supplied to the eggs, uncooled and cooled, was filtered through sand. Several filters were made of herring barrels, as shown in the sketch. On the bottom was set a layer of large stones, covered by a layer of pebbles.



FILTER.

E, egg-box (sheet metal) : *fs*, fine sand : *gr*, gravel : *gs*, coarse sand : *H*, wooden hatching-box (Dannevig's) : *I*, ice tin : *i*, inflow : *J*, ice jacket to egg-box : *o*, overflow : *s*, sieve bottom to hatching-box.

Above that a layer of gravel supported two layers of sand. The latter were each about four inches thick. The lower layer was a coarse sand, while the upper was a fine sand. The two grades were separated by means of a sieve from mixed sand. When the filter became dirty it was easily refilled. Sometimes it was sufficient to replace the upper sand layers with fresh material.

The cooling of the water was, on the advice of Dr. Fulton, arranged in the following manner. The apparatus consisted of a wooden trough 7½ feet long by 1 foot wide by 10 inches deep (see wood-cut) In the trough a number of tins filled with ice, or ice and salt (I), were fixed. They were on guides attached to the two sides alternately, so as to cause the current of water to flow in a zig-zag course. As many as twelve tins, measuring 3 to 5 inches in width, about 10 inches wide, and 14 inches high, were placed in the trough. The partially cooled water passed out from the bottom of the trough at (i) into the hatching apparatus. It then met a series of two or three tins filled with ice. For a short time at the beginning of the experiment a mixture of ice and salt was put into the tins. Passing these, it entered the sheet-steel egg-box (E), which was surrounded with ice (J), and which had a lid filled with ice. The water then proceeded to another egg-box or into a hatching-box (H), as shown in the drawing. In this case the hatching-box contains spawn on gravel (gr). The arrow denotes the course taken by the water. The letter (o) denotes the overflow.

The temperatures were taken by the attendant for the most part, but from time to time by myself. The observations were made, with few exceptions, from three to seven times in the twenty-four hours.

Lot I.—February 18.—The water in the barrel in which the spawn was brought to Aberdeen was dirty ; it had been got at low water in Anstruther harbour. On arrival the temperature of the water was 5·6° C., with a specific gravity of 27·2. The temperature of the water in the hatchery was 4·4° C., and the specific gravity 27·2. The plates were left in this running water overnight.

—— February 19.—The plates were taken out of the water at 3·2° C., and put directly into a cooled egg-box in which the water was at 0·4° C.

Lot II.—February 19.—When this lot arrived at the Laboratory the water in the barrel was at 6° C. The plates were put into running hatchery water at 3·6° C. till next day.

—— February 20.—The plates were transferred from the water at 3·8° C. to egg-boxes at 0° C. and —1° C. respectively.

Lot III.—February 19.—On arrival the eggs were put into the hatchery water at 4° C.

—— February 20.—The plates were transferred at 8 a.m., directly from the water at 3·8° C. to the cooled water at 0° C. and —·4° C.

An egg was examined shortly after the plates had been put into the cooled water. It was in the blastodisc stage (fig. 1). The zona was torn at the point where the egg had adhered to the plate. A small piece of weed was adhering to the zona.

At 11 a.m. a box containing one plate of Lot III. was taken out of the cooling apparatus when the water was at —1·8° C. The box was left standing to permit of the water warming up. At 2.20 p.m it was at 1° C., and by 7.45 p.m. it had reached a temperature of 5·4° C. A current of water at 5·6° C. was then started flowing through the box. This box received water at the ordinary temperature after this date.

On February 21 a plate each from Lots I. and II. were put into this box. That from Lot I. was taken from 0·3° C. and put straight into water at 1·4° C. An hour-and-a-half later the water registered 4·6° C., and the plate was then transferred to the tin at 6·8° C. The plate of Lot II. was shifted directly from water at ·4° C. to water at 2° C., and then from 2·1° C.

into the tin at 8·2° C. For the temperature of the water from this time to March 25 see Table, p. 106.

The eggs on the three plates were examined at this date. Under the lens the eggs of all three lots were seen to have been fertilized; the blastodisc and a wide perivitelline space were apparent. The double egg-membrane was more or less distinctly made out. The egg of Lot III. measured 1·4 mm. across the outer envelope, while the yolk sphere was ·9 mm. in diameter. The eggs were stuck very fast to the glass plate, and could not be dislodged by a brush. A knife was required to remove them. Of five eggs examined, one was dead; the others were in excellent condition. The dead egg had a wide perivitelline space, but the yolk sphere was shrunken. It appeared to have been fertilized.

February 22—An egg of Lot I. showed a large thick blastodisc now saucer-shaped (fig. 2). The disc covers the yolk like a cap. A number of rod-like crystals are present inside the zona. In Lot II. the saucer-shaped disc had a comparatively thin outline (fig. 3). The blastodisc was composed of very small cells; it covered half the yolk sphere. The long crystals were present on the inside and outside of the zona, and on the yolk sphere. The two-layered structure of the zona was well seen, since the outer layer (o) which adhered to the glass had broken off, exposing the inner layer (i). The eggs of Lot III. were in the same stage as Lot II. While the egg of Lot I. was in the Laboratory, viz., 4 hours, it developed from the stage drawn (fig 2) to that shown by the egg of Lot II. (fig. 3).

February 23.—An egg of one of the lots which was examined on February 22 was left till the following day in a glass cell, in which it was barely covered with water. It had reached the condition shown in Fig. 4. The blastoderm almost, if not quite, covers the yolk.

February 25.—In Lot I. the embryo was about half-way round the yolk (fig. 5). Kupffer's vesicle was not made out. The eye was dimly visible. There were many long crystals on the outside of the zona; they were apparently larger than those noted before.

On the plate of Lot II. the live eggs were at the same stage as Lot I. (fig. 6). Long crystals were seen inside the zona. Kupffer's vesicle was not seen. The blastopore seems to be closed. In the specimen drawn the eye was not made out, but in another specimen it was distinct (fig. 15). The head is shown in optical section in Fig. 16. A number of dead eggs on this plate had not swollen out to the size of the live eggs. A slight perivitelline space was visible, but it was not so extensive as that of a live egg. The dead eggs were easily dislodged by the touch of a pipette, whereas the live eggs stuck hard, and were forced off with a distinct jar. These dead eggs did not appear to have been fertilized.

Lot III. were at the same stage as Lot I. The crystals both inside and outside the zona were very long and numerous.

March 2.—A sample of the eggs of Lot I. was scraped off. All were alive save one. The embryo now showed a free tail (fig. 7). At this stage the embryo almost completely encircled the yolk. The eggs of Lot II. (fig. 8) were slightly further developed. The tail was now further away from the head. With the growth in length in the free portion of the tail, the snout and the point on the yolk sac where the tail began have grown further and further apart. Lot III. (fig. 9) was ahead of Lot II. The eggs of Lots I. and II. were very dirty.

March 4.—The eggs were doing well. The tail in Lot I. (fig. 10) has grown much in length, although it is not much in advance of the stage that had been reached by Lot III. two days previously. The embryo on Lot II. was slightly further developed than Lot I. There was a large quantity of crystals inside the eggs. Although Lot III. was fertilized one day later than

Lot I., the embryos were further advanced, because it was in the cooled water for a shorter time (see Table, p. 106).

March 11.—In Lot I. the little fish was well formed: the eyes were pigmented black. The tip of the tail came round to near its origin from the yolk sac (fig. 11). One embryo examined was in a less advanced condition; the eyes were not pigmented. The only pigment visible in the embryo at this date was in the eyes. There were little colourless patches all over the head. The heart was beating slowly.

March 16.—The stage arrived at by Lot I. is shown in Fig. 12. The embryo, which was now nearly ready to hatch, was lively. It twisted itself about like an eel inside the zona. The heart was beating, and the long points from which the yolk is absorbed were visible on the anterior end of the yolk mass. There was a green iridescence in the dark eyes.

March 19.—The first fry (fig. 55), only a few in number, were obtained on this date from Lots I., II., and III. Hatching had taken place from each plate, after a period of incubation of 29 days in the case of the first two and of 28 days in the case of Lot III. In estimating the time of incubation, a new larva found on any date will be regarded as having been hatched on the previous day. The plates were examined. Lot I. contained the largest quantity of dead eggs; Lots II. and III. were in better condition. Several fry hatched out while the plates were being examined—most from Lot III. Although the eggs of Lot III. were the dirtiest, that plate contained the smallest number of dead eggs. Up till this date a strong current of water was flowing through the box. The egg when ready to hatch is translucent and colourless except for the two opaque silvery eyes, which show as dark points.

March 20.—A large number of fry was obtained.

March 22.—A few more fry appeared on this date.

March 23.—About 40 larvæ had hatched out since the previous day. A good deal of fungus had appeared on the plate of Lot III.

March 24.—Some fry had appeared since the day before. The plates of these lots had patches of fungus on them, and most of the eggs were dead, apparently just lately. Some of the eggs were still alive.

March 25.—Two larvæ were got on this date.

March 27.—The plates of eggs were taken out and examined to-day. The plate of Lot I. was well covered with a thin scum of mould. The fungus could be lifted off in a matted sheet. There was a large proportion of the total quantity of eggs on the plate still adhering dead. A good proportion of these contained well-developed embryos, the tail being fairly long. Some had died when ready to hatch. The fungus is a mass of delicate hyphæ (figs. 13 and 14). There are also present on the shells of the dead eggs the round white granular masses found on the eggs in the cooled water (Pl. I., fig. 57). In *b* and *c* (fig. 13) are given enlarged drawings of the hypha in which granules were arranged in little box-like collections. A spindle-shaped body shown in *a* (fig. 13) was observed floating about; it was a little broader than one of the hyphæ. Lots II. and III. were similarly attacked. Lot II. had very few eggs, but they were covered by the matted fungus. The extensive destruction of the eggs and the appearance of the fungus had occurred since the previous examination of the plates on March 19. Did the fungus cause the death of the eggs or did it develop after they had been otherwise killed? The current of water flowing through the ova had been decreased, and this may have acted injuriously on the eggs. Although it is possible that when the fungus had obtained a good footing, it might of itself prove the destruction of the eggs still alive.

The empty egg-capsule, from which the larva has issued, has sometimes merely an irregular tear across it; at other times a piece has been taken out completely (fig. 17).

On one part of the plate of Lot. I. there were 85 eggs on a surface half-an-inch (12·5mm.) square. They were arranged in one layer.

The eggs hatched after periods of incubation varying from 28 to 35 days, in water of the temperature given in the following table :—

Table giving the temperature of the water during the period of Incubation.

	I.	II.	III.		I.	II.	III.		I.	II.	III.
Feb. 18	*F.										
,, 18	4·4,5·6			Mar. 1	3, 5	3, 5	3, 5	Mar. 13	4·8	4·8	4·8
,, 19	0, 3·2	F.3·6, 6	F. 4	,, 2	2·8, 4	2·8, 4	2·8, 4	,, 16	4·4	4·4	4·4
,, 20	–1·8, 0	–1·6,3·8	–·4,5,6	,, 3	4·5	4·5	4·5	,, 17	4·2	4·2	4·2
,, 21	0, 6·8	·4, 8·2	6·8,8·7	,, 4	4·9	4·9	4·9	‡ ,, 18	4·2	4·2	4·2
,, 22	6·6	6·6	6·6	,, 5	4·4	4·4	4·4	,, 19	*f* 4·5	*f* 4·5	*f* 4·5
† ,, 25	3·6,4·8	3·6,4·8	3·6,4·8	,, 7	4·3	4·3	4·3	,, 20	*f* 5·3	*f* 5·3	*f* 5·3
,, 26	3·6,4·2	3·6,4·2	3·6,4·2	,, 8	4·2	4·2	4·2	,, 21	5·6	5·6	5·6
,, 27	3·2,4·6	3·2,4·6	3·2,4·6	,, 9	4·4	4·4	4·4	,, 22	*f* 6·7	*f* 6·7	*f* 6·7
,, 28	1·4,3·4	1·4,3·4	1·4,3·4	,, 10	5·4	5·4	5·4	,, 23	*f* 8·3	*f* 8·3	*f* 8·3
,, 29	2·2,2·8	2·2,2·8	2·2,2·8	,, 11	5·7	5·7	5·7	,, 25	*f* 5·6	*f* 5·6	*f* 5·6
				,, 12	4·6	4·6	4·6				

*F. indicates the date of fertilization of the eggs.

† The temperatures on the following dates have been omitted :—Feb. 23 and 24; Mar. 6, 14, 15, and 24. ‡ Date upon which fry was obtained. *f*. Fry.

Lots I., II., and III. in Cooled Water.—Ic. IIc. IIIc.

The majority of the eggs of Lots I., II., and III. were kept continuously in cooled water. They are designated by the numbers Ic., IIc., and IIIc

Feb. 21.—The eggs of Ic. exhibited a solid blastodisc at this date (fig. 18). A very large quantity of little rod-like crystals were present inside the zona on the yolk. These crystals (cr, fig. 26, etc.), were present in large numbers inside the zona in the cooled eggs.

Feb. 24.—The eggs of Ic. and IIIc. now showed a saucer-shaped cap similar to the condition shown in fig. 3. The crystals were numerous inside the zona in IIIc. The edge of the blastoderm extended to about the middle of the yolk-sphere. IIc. had the solid blastodisc shown in figs. 19 and 20. One egg which had a solid disc was left in a watch-glass overnight in the Laboratory. Next morning the germ was in the thin saucer-shaped condition (fig. 3). Some eggs showed a depression (de) in the yolk under one side of the blastodisc (fig. 21).

Feb 26.—The eggs of Ic. (fig. 22) were not very much advanced on the stage found at the previous examination. The exterior of the egg was very dirty. The sample of eggs of IIc. showed various stages of the blastodisc (*cf.* figs. 20, 23, 24, 2, 3): one was seen in the stage of fig. 22. In IIIc. the stages observed are shown in figs. 24, 25, and 26. There was a great quantity of crystals present in the yolk and on the inside of the zona, and especially at the edge of the blastoderm, where the latter appeared to be pushing the crystals in front of it. The crystals (cr) are shown in fig. 26, in which the blastopore seemed to be about to close.

March 2.—Ic. and IIc. were examined. The eggs are in the stage where the blastopore (b.p.) is closed (fig. 27). There was a good number of dead eggs. The plates occupying the last position in the cooled boxes, No. 1 and No. 2, had no live eggs on them. The eggs, which were very dirty, had been in the disc stage in the majority of cases at death, but some were noticed in stages up to the closure of the blastopore. I consider that the death of these eggs was due to insufficient aeration. A good many of the eggs of IIIc. also were dead. The live eggs were in the stage shown in fig. 28. The blastopore was closed, but I could not make out a free end to the tail.

March 3.—A slide of IIc. was examined on this date. The eggs were nearly all dead; a few live eggs appeared here and there among the dead. One egg was in a backward condition; the blastoderm covered only two-thirds of the yolk (fig. 29). The long crystals were present.

March 5.—The eggs of Ic. did not show much advance on the stage of March 2. The tail had not begun to project yet (fig. 30). The eye can be faintly made out. The live eggs of IIc. and IIIc. were in a somewhat similar condition. One of the latter showed the tail just starting free (fig. 31). The eyes, although probably present, were not made out; the dirty condition of the zona tended to prevent complete examination. A plate of each lot was examined, and in the case of Ic. and IIIc. a few live eggs were found, while in the plate of IIc. all were dead. In the plate of Ic., where the eggs were in two layers, the under layer next the glass sometimes contained several live eggs. Where the eggs were in a single layer, an occasional live egg only was noticed.

March 9.—The stages reached by the eggs of Ic. are represented in figs. 32 and 33. The former exhibits a small free tail.

March 11.—The average condition of the eggs of Ic. on this date is given in fig. 34. One was noticed a little further advanced, the tail being slightly longer. The eggs of IIIc. were distinctly further on (fig. 35).

March 13.—A live egg of Ic. showed the condition exhibited in fig. 36.

March 16.—The egg of IIc. had the tail beginning to project.

March 18.—In IIIc. one or two of the eggs were found in which the tail projected a little. One of these was left overnight in a glass cell in the Laboratory. Next day it had developed to the stage shown in fig. 37. The heart was beating gently and slowly. Very many of the eggs of Ic. and IIIc. were dead. The live eggs were few in number, and were imbedded among the dead eggs.

March 24.—One of the plates of Ic. had no live eggs on it. Some of the eggs seemed to have died recently. In one of the dead eggs the tip of the tail reached to the head. Many of the dead eggs were covered with small circular white patches (fig. 38). They could be removed along with the outer layer of the egg-shell. An enlarged drawing of a portion of one of these masses is shown in fig. 57. The organisms of which the masses were composed are shown in figs. 39–46. They probably only grow on the matter which exudes from a dead egg through the pores in the zona.

March 29.—The last remaining plate of IIc. was examined. All the eggs were dead.

March 31.—Some eggs of Ic. which were scraped off one of the plates were dead.

April 2.—No fry was seen in Ic.

April 8.—A plate of Ic. showed no live eggs. The eggs were covered with the white patches mentioned above.

April 9.—Another plate of Ic. was examined. No live egg was found. Most of the eggs had died lately, some at the closure of the blastopore. All the eggs on a plate of IIIc. were dead. One of the eggs contained a dead fully-formed larva with black pigmented eyes.

April 10.—On scraping the eggs off a plate of Ic. one egg was obtained containing what appeared to be a live embryo (fig. 47). The embryo was transparent and had black pigmented eyes. I did not, however, see the heart beat, nor was the embryo observed to move. It was kept till next day, when it came opaque, a certain indication of death. A number of dead larvæ was released from the eggs when the plate was scraped. In some of these the tail reached to the auditory capsule.

So far as I am aware, no fry was hatched from any of these three lots in cooled water.

TABLE giving the Temperature in degrees centigrade of the Cooled Water in which were the Eggs of Lots Ic., IIc., and IIIc.

Date.	Ic.		IIc.		IIIc.		Date.	Ic. and IIc.		IIIc.	
	†M.	‡m.	M.	m.	M.	m.		M.	m.	M.	m.
Feb. 18	*F.5·6	4·4	F....	...	...	...	Mar. 4	1·6	·6	2·4	·8
,, 19	3·2	0	6	3·6	F....	4	,, 5	2·4	·9	3·2	1·6
,, 20	0	−1·6	3·8	−1·6	3·8	−1·6	,, 6	2·4	1·2	3·2	1·6
,, 21	·4	0	1·2	− ·4	1·2	−1·4	,, 7	1·8	·8	3	1·8
,, 22	2	− ·4	1	·4	2·4	− ·4	,, 8	1·8	·4	3	1·2
,, 23	3	·6	2·2	0	3·4	1·2	,, 9	2	·4	2·8	2
,, 24	2·4	·6	2·2	−1	2·8	1·6	,, 10	2	·8	3	2
,, 25	3	−1·2	2	−1	3·4	1·2	,, 11	1·6	·6	2·8	1·8
,, 26	2·4	·4	2	−1·4	2·8	1·6	,, 12	1·4	·2	3	1·3
,, 27	2·4	·4	1·8	·2	3	1·2	,, 13	1·6	·4	2·4	1·4
,, 28	1·2	·4	6	− ·2	1·6	1·2	,, 14	2	·8	3	1·6
,, 29	1·2	·6	·8	− ·2	1·8	1·2	,, 15	2·8	·8	2·6	2·2
Mar. 1	1·4	·4	1	·2	1·8	1·6	,, 16	2·2	1·2	2·8	2·2
,, 2	1·6	·4	1·4	0	2·4	1·4	,, 17	2	1·4	2·6	2
,, 3	1·4	·4	2·4	− ·6	2·4	1·2	,, 18	2	1	2·5	1·6

Date.	Ic. and IIc.		IIIc.		Date.	Ic. and IIc.		IIIc.	
	†M.	‡m.	M.	m.		M.	m.	M.	m.
Mar. 19	1·6	1	2·4	1·4	Mar. 31	2·2	·8	3·4	1·6
,, 20	1·6	1	3	1·6	Apr. 1	2·8	1	3·4	2
,, 21	1·4	1	2·2	1·6	,, 2	2·1	1·4	2·8	2·2
,, 22	1·5	1·2	2·4	1·6	,, 3	2·4	1·4	3	1·8
,, 23	2	1	3·1	2·8	,, 4	2	1·2	3	1·6
,, 24	1·6	·6	3·6	2·8	,, 5	2·2	1	2·5	1·2
,, 25	1·2	·6	3·4	1·6	,, 6	2	1	2·8	1·2
,, 26	1·2	·8	2·4	1·8	,, 7	1·2	·6	1·4	1·1
,, 27	2	1	4·4	1·6	,, 8	2·4	1·4	2·6	1·8
,, 28	1·6	1	2·6	1·6	,, 9	3·8	1·6	2·4	1·6
,, 29	2	·5	3	2·2	,, 10	4·2	2·5	..	...
,, 30	2·4	1·4	3·2	2·2					

* F.—Date of fertilization.
† Maximum of three to seven readings daily (day and night).
‡ Minimum ,, ,, ,, ,, ,, ,,

Fourth Lot of Spawn.—The eggs were fertilized at St. Monance between 1 and 3 a.m. on February 29. They were obtained from live females and also from females which had died a short time previously. The milt was taken from live males. The plates were packed at 7.30 a.m., and unpacked at Aberdeen at 3 p.m. The water in the barrel was at that time at 2·8°, the hatchery water was 3°, while the cooled water was 1·7° C.

This lot was divided; the larger part (IV.) was put into uncooled water, while the remainder (IVc.) was transferred to cooled water.

Some spawn (IVb.) was found free or stuck to the bottom of the barrel in which the herrings had been kept alive on the fishing-boat. This was put into the water of the hatchery at the ordinary temperature, but instead of being in the metal egg-boxes in which the rest of Lot IV. was kept, it was kept in a Dannevig hatching-box. On March 23 it was transferred to a shallow floating hatching-box. The eggs were single or stuck together in small groups or in big lumps. The lumps were, in some cases, quite one inch in thickness and over one inch in length. There was a big proportion of the eggs arranged in little groups of two, three, or more. The eggs in the large lumps died early, but a large proportion of those in the little groups survived and hatched. On March 17 the eggs in the largest lump were practically all dead. On 23rd March the remaining lumps were nearly all dead. The mass of eggs is tough, and is not readily broken. The eggs in the largest lump had died early, the eggs being in the disc stage. One of the smaller lumps had a few live eggs in the interior surrounded by dead eggs.

The eggs on the glass plates died in large numbers in the metal egg-boxes, but a considerable proportion hatched out.

February 29.—About twelve hours after fertilization some of the eggs of IVB. were examined. They were in good condition. The perivitelline space was large, and the blastodisc was segmented into two or four (fig. 48).

March 1.—The eggs of IVB. were in the condition shown in fig. 1. The disc was completely segmented. The eggs examined the previous day had been left overnight in a glass cell; they were at a similar stage.

March 3.—IV. and IVB.—The eggs on the glass plates and also IVB. at this date showed the disc in a saucer-shape of approximately the stages shown in figs. 2 and 3.

March 4.—IV. and IVB.—The eggs were not much advanced on the condition found on the preceding day. They were, however, in good condition, and the stages shown in figs. 2, 3, and 4 were exhibited by some of them. There were quantities of long crystals outside and inside the egg-shell. The great majority of the eggs of IVB. were alive.

March 7.—IV.—The blastopore was closed (fig. 5). The eye was visible, but the pupil was not made out. A Kupffer's vesicle was noticed. Long crystals were present inside the zona.

March 13.—IV.—The tail of the embryo almost reached the head. (*Cf.* fig. 9.)

March 17.—IVB.—One of the eggs had an embryo in which the tip of the tail reached to the neck, approximately the condition shown in fig. 11. In IV. there was considerable variation in the stage of development. In some the end of the tail was just short of the head (*e.g.*, a little further on than fig. 9), while in others the tail reached past the head. (*Cf.* fig. 11.) A great quantity of crystals was observed on the embryo and on the zona.

March 18.—IV.—One egg was examined. At first no movement either of the embryo or of the heart could be detected. After a little the heart began to beat steadily, and the embryo twisted itself round in the egg. This was probably in consequence of the rise in temperature due to its transference to the Laboratory). The embryo lay a long time passive. Next morning the egg was alive; the heart was beating slowly but vigorously.

March 23.—IV. and IVB.—Some fry was obtained to-day from each portion of the spawn—that is, after an incubation period of 23 days. On this date the eggs of IVB. were transferred from one box to another, and the larvæ were hatching out during the operation. The movement probably aided the escape of the fry from the eggs. The temperature of the water was 6°. Some of the eggs were left for three-quarters of an hour in a glass cell. The temperature rose to 8°. Two larvæ hatched out. The egg-capsules from which the fry had escaped were ruptured irregularly; in one case a piece of the zona had been taken out. The capsules were very dirty, and infusors were running about them.

March 24.—IV. and IVB.—130 fresh larvæ were counted on this date.

March 25, 26, 27, 28.—IV. and IVB.—Larvæ were obtained. On the last date some of the eggs of IVB. were still unhatched. Occasionally an egg is seen whirling round. This is due to the larva having managed to push its tail out.

March 30, 31, April 1.—IV. and IVB.—Some more larvæ were got.

April 3.—A few of the eggs of IV. were alive and unhatched, but the great mass of the unhatched eggs are dead and covered with fungus.

April 5.—One live larva was obtained from IV.

April 8.—No fry had been obtained from IV. since April 5. There was a considerable quantity of dead unhatched eggs, and the plates were covered with fungus. The plates were cleared away.

The first fry had hatched after 23 days, the last after 35 days. The temperature of the water during this period is given in the following Table :—

The Temperatures of the Water in which the uncooled Lots IV. and IVB. were kept. Degrees centigrade.

Date.	IV. and IVB.		Date.	IV. and IVB.	
	*M.	†m.		M.	m.
				Fe.	
Feb. 29	‡F. 3	2·8	Mar. 19	5	3·8
Mar. 1	3·6	3	,, 20	4·8	4·1
,, 2	3·6	3·4	,, 21	5	4·2
,, 3	4·2	3·6	,, 22	5·4	4·2
,, 4	4·6	3·8	,, 23	§*f* 6·4	5
,, 5	4·6	3·8	,, 24	*f* 6	5·4
,, 6	4·6	4·4	,, 25	*f* 5·6	5·3
,, 7	4·4	4·2	,, 26	*f* 5·4	4·4
,, 8	4·6	3·5	,, 27	*f* 5·8	5·2
,, 9	5·2	4·2	,, 28	*f* 5·8	5·4
,, 10	5·2	5	,, 29	6·5	5·5
,, 11	5·2	4·2	,, 30	*f* 5·4	5
,, 12	5	4·6	,, 31	*f* 5·6	4·6
,, 13	5	4	April 1	*f* 5·6	4·4
,, 14	5·2	4·4	,, 2	6·4	5·4
,, 15	5	3·9	,, 3	6·4	5·6
,, 16	5	4·6	,, 4	6·1	5·6
,, 17	5	4·3	,, 5	*f* 6	5·4
,, 18	4·8	4·2			

* Maximum of three to seven readings daily (day and night).
† Minimum ,, ,, ,, ,, ,, ,,
‡ F.—Date of fertilization. § Date upon which fry ("*f*") was obtained.

The Cooled Eggs of the Fourth Lot of Spawn—IVC, IVC^1, IVC^2.

Of this lot of spawn three batches were cooled independently. One, IVC, was cooled from the time of its arrival at Aberdeen. The second, IVC^1, was put into cooled water on March 7, after it had been a week in the ordinary hatchery water. On this date the eggs were at the stage when the blastopore is just closing (figs. 5 and 6). The third batch, IVC^2, was shifted into cooled water on March 18, when the tail of the embryo reached round to the neck. *Cf.* fig. 11.

March 3.—IVc.—The eggs showed a germ in a disc stage of very small cells; *cf.* fig. 20. A great quantity of crystals was present inside the zona.

March 4th.—IVc.—The egg examined was in disc stage (fig. 20). Some of the eggs were dead.

March 5th.—IVc.—The disc showed a tendency to become saucer-shaped (fig. 49). Here also there was a large number of crystals.

March 7.—A plate of IV., which had up till now been in the ordinary hatchery water, was on this date transferred to cooled water. It was placed horizontally, with the eggs uppermost, in an egg-box. The plate rested on the top of the inclined guides, p. 102. The eggs were in the stage of development exhibited in figs. 5 and 6. This plate is now labelled IVc^1. It was transferred at 2.45 p.m. from water at 4·3° into water at 2·6° At 3.30 p.m. the temperature had fallen to 1·4° C. The plate was exposed momentarily to the air when being removed to its new situation.

March 11.—IVc.—This batch consisted of three glass plates bearing eggs. They were arranged in an egg-box, standing obliquely, eggs downward, as shown in E, p. 102. The eggs of the first and third plates were nearly all dead. On the middle plate they were nearly all alive. The dead eggs had died while in the disc stage. The live eggs were mostly in the stages shown in figs. 50, 51, and 6. One, however, had a germ similar to that of fig, 2.

March 18.—IVc^1.—The eggs were apparently doing well; a few were dead. A deposit of fine mud was removed from the eggs by means of a pipette.

April 4.—IVc^1.—Half of the eggs on this plate seemed to be alive. They were very dirty. The eggs upon which the incoming water impinged directly were cleaner than those situated a little away from its immediate action.

April 9.—IVc^1.—A good number of the eggs were seen to be dead at this date. The live eggs were at the stage shown in fig. 52. The eye had black pigment in it. Two of the eggs which were examined seemed almost ready to hatch. The dead eggs were covered with the white colonies mentioned on p. .

April 14.—For most of the preceding period the water from IVc. has passed into the box containing IVc^1. By this date the order had been reversed, and a trap for any larvæ which might be hatched had been arranged. It consisted of an ordinary hatching-box placed so as to receive the outflow from IVc.

April 15.—IVc., IVc^1.—Four live larvæ and a dead larva were obtained from these eggs. They are the first fry to be noticed, and they represent an incubation period of 46 days. They may have come from either IVc. or IVc^1, or from both.

April 16.—Two live larvæ were found. In IVc^1 there were some eggs alive; the majority were, however, dead.

April 17.—One live larva appeared on this date. Some of the eggs of IVc^1 were still alive.

April 18.—Four live larvæ were obtained. It seems that when the eggs arrive at a condition ready for hatching a rise in temperature at once liberates them.

April 19.—No fry was obtained on this date. Some of the eggs of IVc^1 were still alive. The weather was colder, and the temperature of the hatchery water did not rise so much as usual during the night.

April 20.—One live larva was in the trap in the forenoon, and by 2.20 p.m. another had hatched out. There was a small patch of live eggs on the plate of IVc^1. They were not immediately below the inlet, but a little in front, and in the direct line from the inlet to the outflow of the box.

The last remaining plate of IVc. was examined. It had not been possible to examine this plate properly since it was set in the egg-box in a slanting position. It was necessary in this case to lift the slide out of the water and transfer it to a tray containing water before it could be examined. This was avoided in case the exposure of the eggs to the air might injure them. No live eggs were at this date found on the plate. The eggs were all much swollen and dirty. They were covered with a layer of white patches (*vide* p. 107). In some places the growth had a pinkish colouration. The contents of nearly all the eggs had disappeared. When the eggs were scraped off the plate, a few dead larvæ were turned out. One appeared to have been ready to hatch, and others were in the stage where the tip of the tail reached to the back of the head (*cf.* fig. 11). Two eggs contained larvæ which were so recently dead that they were still in greater part transparent. The eggs of IVc[1] alone remained from this date.

April 21.—No fry was obtained. Live eggs were, however, noticed.

April 22.—One live larva was got on this date.

April 23.—No fry appeared. There were still a few live eggs.

April 24.—No live fry was found. One live egg was seen. The plate of IVc[1] was shifted from the cooled water to the uncooled hatchery water (4·8° C.).

April 25.—One larva was obtained. It was in good condition. Some eggs appeared to be still surviving.

April 26, 27, 28, 29.—No fry was obtained. On the 29th a live egg was observed.

April 30.—No fry was found. All the eggs on the plate were dead. They were covered with a thick coat of debris. Many of the embryos had died about the stage of the closure of the blastopore.

The fry then appeared at intervals of from 46 to 55 days after fertilization.

IVc[2].—March 18.—This plate of eggs had been kept at the ordinary temperature of the hatchery water in one of the metal egg-boxes. The great majority of the eggs were alive. The temperature of the water was 4·2°. The plate of eggs was cooled to 2° and then transferred to a hatching-box supplied with cooled water of 1·2° C. It was retained in the cooled water until the eggs hatched. One of the eggs was examined and found to be in the stage represented by fig. 53. The tip of the tail reached to the neck region. The yolk was being rapidly absorbed, and showed the little peaks on the periblast very distinctly. An egg was examined after the plate had been in the cooled water for an hour. The embryo was very quiet; the heart was giving an occasional contraction. It beat for about half a minute, making during that time about six contractions; it then rested for one minute 49 secs., when it started again. During the time it was in the watch-glass the temperature may have risen.

March 24.—Two eggs of this lot on this date seemed to be ready to hatch. They were examined immediately on being removed to the Laboratory. The heart was beating steadily. The eggs lived in the glass cell till the 27th, when both appeared to be dead. Neither had hatched, although one of them when seen on the 28th had managed to get its head out.

March 29.—Fourteen larvæ were obtained from this batch of eggs. They were not very active, although they wriggled a little.

March 30.—Forty more larvæ had appeared.

April 1.—No fry was obtained on this date. The plate of eggs was shifted from water at 2° into a new situation where the water was at 2·8° C. Some of the eggs were dead, but the majority was alive and unhatched. From this date onwards the water supplied to these eggs was warmer than before.

April 2, 3, 4, 5, 6, 7, 8, 9, 10.—Larvæ were obtained on each of these dates. On April 2, 55 were got; on April 9, 70, and on the 10th, 20. On the 5th, 6th, 7th, and 9th the fry was noticeably rather livelier than on the other dates.

April 11, 12, 13.—No live larvæ were seen. The plate was examined on the last date. A great number of the eggs had been killed when on the point of hatching. The eyes were well pigmented and silvery.

The fry then appeared at intervals of from 28–41 days after fertilization. The eggs of this lot which remained uncooled (viz., IV.), hatched out in 22 to 35 days.

The Temperature of the Cooled Water in which Batches IVc, IVc^1, and IVc^2 were kept. Degrees centigrade.

Date.	IVc.		IVc^1.		Date.	IVc.		IVc^1.		IVc^2.	
	M.	m.	M.	m.		M.	m.	M.	m.	M.	m.
										For the Temperature up to Mar. 18, *vide* IV., Tab. p. 110	
Feb. 29	F.3	1	F.3	2·8	Mar. 15	2	1·2	1·6	·8		
Mar. 1	1·2	·9	3·6	3	,, 16	2·6	1·6	2·4	1·4		
,, 2	1·6	·4	3·6	3·4	,, 17	2·4	1·6	2	1·4		
,, 3	1·4	– ·4	4·2	3·6	,, 18	2·2	1·2	2	1	4·2	1
,, 4	1·6	·6	4·6	3·8	,, 19	2	·6	1·6	·8	2	1
,, 5	2·8	·7	4·6	3·8	,, 20	2	1	1·8	1	2	1·2
,, 6	2·6	1·4	4·6	4·4	,, 21	1·5	1·2	1·4	·8	1·8	1·4
,, 7	2·4	1·3	4·3	·1	,, 22	1·5	1·2	1·4	1·2	1·8	1·2
,, 8	2·2	·6	1·4	·6	,, 23	2·2	2	2	1·8	2·4	1·4
,, 9	2·2	1·5	2	1·4	,, 24	2·4	1·8	2	1·5	2·6	1·4
,, 10	2·4	1·2	2·2	·8	,, 25	1·5	1	1·4	·8	2·4	1·2
,, 11	2·2	·5	2·2	·5	,, 26	2	1·2	1·6	1·2	2·2	1·2
,, 12	1·6	·1	1·4	·5	,, 27	3·2	1·5	3	1·6	2·4	1·5
,, 13	2·2	·6	2·2	·4	,, 28	2·2	1·5	1·6	1·4	1·8	1·6
,, 14	2·2	·6	2·2	·8	,, 29	2·4	1·4	2	1·3	*f3	1·6

Date.	IVc.		IVc^1.		IVc^2.		Date.	IVc.		IVc^1.	
	M.	m.	M.	m.	M.	m.		M.	m.	M.	m.
Mar. 30	3·	1·6	2·4	1·4	*f2·8	1·6	Apr. 14	3·2	2	3	2
,, 31	2·6	1·2	2·4	1	2·6	1	,, 15	f2·4	1·4	f2·6	1·5
Apr. 1	3·2	·8	2·8	1	3·6	2	,, 16	f4·2	1·1	f4·4	1·4
,, 2	2·1	1·4	1·8	1·4	f5·2	2·7	,, 17	f4	1·2	f4	2
,, 3	2·6	1·2	2·4	1·2	f4	3	,, 18	f1·3	1	f1·4	1
,, 4	2·6	1·2	2·2	1·2	f3·4	2·8	,, 19	2·2	1·6	2·2	1·6
,, 5	2·2	1·2	2·2	1·1	f3·8	2·2	,, 20	f2·4	1·4	f2·6	1·6
,, 6	2·6	1·2	2·3	1	f3·8	2·6	,, 21	3·2	1·8	3·2	1·5
,, 7	1·6	1·2	1·2	·9	f4	2	,, 22	...	...	f3·4	1·4
,, 8	2·5	1·6	2·6	1·4	f3·2	2	,, 23	...	...	2·3	1
,, 9	2·6	1·8	2·6	1·8	f4·6	2·4	,, 24	...	...	5·8	·8
,, 10	2·8	1·5	3	1·5	f4	2·4	,, 25	...	..	f5	3·8
,, 11	3·4	1·6	3·4	1·6	4	1·8	,, 26	...	...	...	...
,, 12	4·2	2	4·4	2	4·2	1·8	,, 27	...	...	...	...
,, 13	3·4	1·8	3·4	1·6	4	3	,, 28	...	..	...	...

* "f" indicates the date upon which fry appeared.

FIFTH LOT OF SPAWN.—This lot consisted of spawn on gravel. It was in the form of large masses, small groups of eggs, two or three and upwards, attached to pieces of gravel, or simply to one another, or single eggs free or attached to stones. There was a great quantity of single eggs.

March 5.—The eggs fertilized on the morning of March 5 arrived at the Laboratory on the evening of the same day. They were kept in the hatchery water over night.

March 6.—The spawn was divided, part kept in uncooled water, the remainder in cooled water. An egg was examined. The disc was large and segmented (*cf.* fig. 1).

The Uncooled Spawn—V.—The uncooled spawn was put into shallow enamelled trays and a circular wooden tub. The water flowed through these in series. The depth of water varied from half-an-inch to two or three inches; the trays were set with a slope on the bottom. The trays and the tub were turned round each day so as to alter the run of the water. This was done with the view of preventing the formation of dead water.

The large pieces of spawn were kept in a floating wicker-basket and in a hatching-box (p. 102). On March 26 these eggs were nearly all dead. In the interior of the mass the eggs had died in the disc stage. On some of the smaller pieces the embryos had been well on before death occurred, having reached the stage in which the tip of the tail touched the head. On March 31 all the eggs in the big lump were dead and covered with fungus. A few fry had apparently been hatched from them.

March 11.—Some of the eggs were examined. They were at the stage where the blastopore is closing (*cf.* figs. 5, 6, 27, 51).

March 26.—Many of the single eggs were dead, They lay on the bottom packed close with other single eggs or under the gravel, and in that way did not receive efficient aeration in the trays. Where several eggs were stuck together the mortality was not so marked. The single eggs had not, as a rule, expanded to the same extent as the eggs that were joined together. Some of the dead eggs had on the zona the round white patches which were noticed above, p. 107. There were numbers of Planarians and swarms of infusors among the eggs. The groups attached to the little pieces of stone seemed to do well. Four larvæ hatched out while the eggs were being shifted about. When just released from the egg the head of the larva was in some cases markedly bent downwards (fig. 56).

March 27, 28, 29.—Fry was obtained on each date.

April 1, 4, 5.—A large quantity of fry was got on these dates.

On April 4 many of the pieces of spawn were dead and covered with fungus. In the trays the eggs have been fully exposed to the light, and this may have had a detrimental effect upon them.

April 6, 8.—On the former date a few larvæ appeared, and on the latter one was got.

April 12.—Another herring had hatched out during the night. The gravel amongst which the spawn was distributed was covered with a brown coat of diatoms. The great majority of the eggs were dead. Some had died in the early stages. The single eggs were dead in large quantities; some were black. The pieces of spawn on the top of the gravel were covered with fungus. A large proportion of the eggs had died when the blastopore was closing or had closed, and some were in the stage where th tail reached to the nape of the neck. Death seemed to have been gradually overtaking the eggs.

April 13.—No fry was found to-day. The eggs were cleared out.

The period of incubation had been from 21 to 37 days.

Temperature of the Water in which the Uncooled Eggs of the fifth lot of Spawn were kept. Degrees centigrade. The temperature was not taken oftener than once a day.

Date.	V.	Date.	V.	Date.	V.	Date.	V.
Mar. 5	F.4.5	Mar. 14	. .	Mar. 23	8·3	Apr. 1	*f* . .
,, 6	4·4	,, 15	. .	,, 24	. .	,, 2	8·2
,, 7	4·3	,, 16	4·4	,, 25	5·6	,, 3	. .
,, 8	4·2	,, 17	4·2	,, 26	*f* 5·8	,, 4	*f* 7
,, 9	4·4	,, 18	4·2	,, 27	*f* 6·6	,, 5	*f* 5·9
,, 10	5·4	,, 19	4·5	,, 28	*f* . .	,, 6	*f* . .
,, 11	5·7	,, 20	5·3	,, 29	*f* . .	,, 7	5·6
,, 12	4·6	,, 21	5·6	,, 30	6·2	,, 8	*f* . .
,, 13	·8	,, 22	6·7	,, 31	6·9	,, 12	*f* . .

Cooled Spawn: Vc.—March 6.—Part of the spawn of the Fifth lot was put into hatching boxes in cooled water. In order to assist the aeration the boxes were lifted, almost every day, for a little distance, and then pressed down into the water. The water rushed in through the sieve-bottom among the gravel and sent the loose spawn flying about.

March 9.—The eggs were examined. They were in the stage shown in fig. 2. A good number of the single eggs were dead.

March 14.—Some pieces of spawn were taken from one of the hatchery boxes and put into a metal egg-box which had been half filled with large pebbles. The lumps of spawn were attached to gravel; they were large, flattened in shape. All appeared to be alive. The box was surrounded by ice, and will be referred to as Vc^{1}.

March 15.—Vc.—By means of a sieve the majority of the dead single eggs were removed. The dead eggs showed a perivitelline space, but it is doubtful if they had all been fertilized. A portion of an ovary was found in one of the boxes. The eggs on the end of the piece where they were uncovered were all fertilized. The little groups of eggs were mainly alive, although dead eggs were noticed among them. The living eggs were at the stage of the closure of the blastopore. (*Cf.* figs. 51, 5, 6, 27).

March 29.—Vc.—The tip of the tail of the embryo reached round to the nape of the neck (*cf.* fig. 11). The eyes were beginning to show a general shading as if towards pigmentation. The heart was beating. Some of the spawn was shifted on this date from cooled water of 3° into the ordinary hatchery water at 6·5° C. It was thereafter kept at the ordinary temperature. It was labelled Vc^{2}.

March 30, April 2, 5, 6.—Vc^{2}.—No fry was found in the box.

April 10.—Vc^{2}.—Some fry was obtained on this date. The water flows into the box at the top and escapes by the sieve-bottom. Owing to the presence of the gravel and spawn on the bottom it is not possible to remove all the larvæ that are free on any date unless the spawn is taken out of the box also. All the fry that was accessible (visible) was removed on the dates specified, so that the appearance of fry in the box on the following day meant that a certain number had hatched out during the night. In other cases the water, flowing out of the box in which the spawn was, escaped from the top of the box and carried away the fry as they were hatched. These were captured in hatching-boxes, which could be emptied each day. It was thus possible to make sure of the exact date of hatching. This arrangement was followed in Vc^1. The former condition was present in the case of Vc. and Vc^2.

April 11 and 12.—Vc^2.—Twenty-seven and sixty-two live fry were obtained on these two days. Some of the fry were smaller than the rest. Some remained curled up in a little ball. They had possibly been released too early in consequence of the wearing out of the egg-capsule and the agitation of the water. Kupffer* said that the egg-shell grew gradually thinner during the development of the egg. The time when hatching takes place is dependent on the amount of resistance that the egg-membrane offers to the muscular action of the embryo. Certain of the larvæ had the heads bent down, and they did not swim normally. All the larvæ were removed from the box on the 12th.

April 13, 16.—Six and eight live fry were obtained on these days. On each date the box was completely emptied. Most of the eggs seemed to be hatched ; one live egg was seen.

April 17.—Vc^2.—One larva just hatched was obtained.

April 19 and 20.—No fry was obtained on these dates. Some of the empty egg-capsules were examined. They showed the two-layered structure well.

The incubation period was from 35 to 42 days. The temperature of the water is shown in Table, p. 118.

April 2.—Vc.—Some larvæ were found in one of the boxes. They did not seem to be quite so large as those hatched from the uncooled eggs. They appeared to have been prematurely hatched. The eyes were not completely pigmented ; the yolk sac was large, and the head was very much flexed. There was no black pigment along the ventral line of the body. The sensory papillæ were visible on the side of the larva. It is possible that the zona had given way in consequence of the friction in the box when it was agitated.

April 12.—Vc.—A quantity of fry was noted on this date for the first time in one of the boxes. 253 were taken out of two boxes.

April 13, 14.—100 were removed on the 13th and 800 on the next day. Some eggs were still unhatched ; some were noticed in the process of hatching.

April 15.—660 larvæ were taken out of various boxes ; 250 at least of them had hatched since the previous day. One box was completely emptied.

April 16.—84 live fry were got on this date.
,, 17.—155 ,, ,, ,, ,, ,, ,, ,,
,, 18.—80 ,, ,, ,, ,, ,, ,, ,,
,, 19.—43 ,, ,, ,, ,, ,, ,, ,,
,, 20.—57 ,, ,, ,, ,, ,, ,, ,, There was a quantity of dead fry among the gravel, and also some living fry.

April 21.—50 live fry were got on this date.
,, 22.—5 ,, ,, ,, ,, ,, ,, ,,
,, 23.—5 ,, ,, ,, ,, ,, ,, ,,
,, 24.—6 ,, ,, ,, ,, ,, ,, ,,
,, 25.—Some of the eggs had been shifted on the previous day from the cooled water to water at the ordinary temperature. On this date two larvæ were obtained from them, and some of the eggs were still alive. No more fry was got from this lot. No fry was obtained from the cooled lot Vc. on this date.

April 26.—Vc.—One live larva was obtained.

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*Kupffer—"Ueber Laichen u. Entwicklung des Herings in der westlichen Ostsee." *Jahresbericht d. Commission z. Wissenschaftl, Untersuch. der deutschen Meere in Kiel* für die Jahre 1874, 1875, 1876. Berlin, 1878, p. 32.

April 27.—Vc.—Three live larvæ were got. None was found after this date. Some of the eggs contained dead embryos.

This batch of eggs hatched out after an incubation period of 37 to 52 days. In this connection the fry that appeared on April 2nd have been neglected. For the temperature of the water see Vc., Table, p. 118.

April 16.—Vc^1.—Some lively fry, 94 in number, were got on this date. The fry were carried away by the overflow and caught in a trap. It was thus possible to separate the fry that hatched out on each date. The trap was emptied each day.

April 17.—100 live fry had appeared since yesterday.
,, 18.—75 ,, ,, ,, ,, ,, ,,
,, 19.—63 ,, ,, ,, ,, ,, ,,
,, 20.—17 ,, ,, ,, ,, ,, ,,
,, 21.—19 ,, ,, ,, ,, ,, ,,
,, 22.—2 ,, ,, ,, ,, ,, ,,
,, 23.—6 ,, ,, ,, ,, ,, ,,
,, 24.—1 ,, ,, ,, ,, ,, ,,
,, 25.—1 ,, ,, ,, ,, ,, ,,
,, 26.—2 ,, ,, ,, ,, ,, ,,
,, 28.—1 ,, ,, ,, ,, ,, ,,
,, 29.—1 dead larva had ,, ,, ,,

On May 1st the spawn was removed. A large quantity of fully-developed larvæ was found dead in the box. These had got trapped in the dead water in the bottom of the box. The spawn in this box consisted of large lumps measuring one inch or more in breadth or length, but less in thickness. The eggs on the edge of the lump had hatched; those inside the lump had died. There was a mould over the pieces. Many of the dead eggs had embryos in them. The eggs inside the lump had developed for some distance, some having reached the closure of the blastopore, although in the centre some had died in the disc stage. The piece does not form a solid mass. There are interstices between the eggs. The eggs inside the mass were quite clean, while the outside was covered with a thick mat of debris, which will in itself tend to prevent the aeration of the inside eggs. Where the temperature was kept low the eggs that died did not succeed in causing the death of all the eggs. It would appear that as the embryo grows in the egg a greater amount of aeration is required, and it is possible that if there had been a system of mechanical aeration the eggs, even inside the lumps, might have developed successfully.

The eggs in this batch remained in the egg over a period of from 41 to 53 days. For the temperature of the water during this time, see Vc^1, Table, p. 118.

Temperature to which the Cooled Eggs of the Fifth lot of Spawn were subjected.
Degrees centigrade.

Date.	Vc.		Vc^1.		Vc^2.	
	M.	m.	M.	m.	M.	m.
Mar. 5	F.		The Temperature up to Mar. 9th was the same as in Vc.			
,, 5	4·5	...			4·5	...
,, 6	4·4	2·5			4·4	2·6
,, 7	2·6	2·4			3	2
,, 8	2·2	1·6			3	·8
,, 9	2·6	2·2	2·5	2	2·2	1·6
,, 10	3	2	3	1·9	2·4	1·6
,, 11	3	1·6	3	1·4	2·2	1
,, 12	2·5	1·4	3	1	2	·8
,, 13	2·6	1	2·2	·9	2	·6
,, 14	3	2	3·6	1·6	2·2	·8
,, 15	2·6	2·2	2·6	2	2·5	1·2
,, 16	2·6	2·3	2·8	2·2	2·4	1·6
,, 17	2·6	2·4	2·6	2	2·2	1·4
,, 18	2·4	1·6	2·5	1·2	2	1
,, 19	2·4	1·6	2·2	1·2	2	1
Mar. 20	2·6	1·8	2·6	1·3	2	1·2
,, 21	2·2	2	2·4	1·6	1·8	1·4
,, 22	2·6	2·4	2·2	1·8	1·8	1·2
,, 23	3·2	2·6	3	1·3	2·4	1·4
,, 24	3·8	2·8	3·2	2·6	2·6	1·4
,, 25	3·5	2	3·2	1·4	2·4	1·2
,, 26	2·6	2	2·4	1·6	2·2	1·2
,, 27	4·2	2·2	4	1·4	2·4	1·5
,, 28	2·6	2	2·6	1·4	1·8	1·6
,, 29	4·6	2·8	2·8	2·5	*6·5	3
,, 30	3·4	2·4	3·2	2·2	5·4	5
,, 31	3·4	2·4	3·4	1·6	5·6	4·4
Apr. 1	3·5	2·6	3·6	1·6	5·6	4·4
,, 2	*f*3	2·8	2·7	2	6·4	5·4
,, 3	3·4	2·4	3·4	1·8	6·2	5·6
Apr. 4	3·4	2·3	3·2	2	6·1	5·6
,, 5	3	2·4	2·8	1·8	5·8	5·4
,, 6	3	2·2	3	1·4	7·4	5·2
,, 7	2·6	2·4	1·8	1·1	6·6	6·2
,, 8	3	2·4	3	2	7	6·8
,, 9	4	2	3	1·8	6·8	6·2
,, 10	3·4	2·6	3	1·2	*f*7	6
,, 11	3·6	2·6	3·6	2	*f*7·2	6·6
,, 12	†*f*4·3	3	4·5	2	*f*6·8	...
,, 13	*f*3·2	2	3	1·2	*f*7	6·4
,, 14	*f*3·6	2	3·2	2	7·8	6·4
,, 15	*f*3	2·2	2·2	1·8	6·8	6·4
,, 16	3·6	2·4	*f*4·2	1·2	*f*7·2	6·2
,, 17	*f*4·2	2·2	*f*4	1·3	*f*7·9	6·8
Apr. 18	2·6	2	*f*1·6	1·2		
,, 19	2·6	...	*f*2·4	2		
,, 20	2·8	2·4	*f*3	1·4		
,, 21	*f*3	2	*f*3	1·2		
,, 22	*f*3	2·2	*f*3	1·2		
,, 23	*f*2·4	1·8	*f*2·2	1·2		
,, 24	*f*2·2	1·4	*f*1·2	1		
,, 25	2	1·4	*f*2	·8		
,, 26	3·2	2·6	*f*3·4	2		
,, 27	*f*3·2	2·8	3	2		
,, 28	...	...	*f*4·6	3·5		

Date.	"Vc.' ‡	
	M.	m.
Apr. 14	*f*3·6	2·8
,, 15	*f* ...	2·7
,, 16	*f*2·7	2·2
,, 17	*f*3·1	...
,, 18	*f*3	1·8
,, 19	*f*2·6	2·4
,, 20	*f*2·6	2
,, 21	*f*2·8	2·2
,, 22	3·3	1·4
,, 23	2·4	1·2
,, 24	5	·8
,, 25	*f*5	3·8
,, 26	*f*5·6	5
,, 27	*f*7·2	5·4

* Vc^2. was shifted on March 29 from the cooled water into the ordinary hatchery water.

† *f* Denotes that fry was obtained on that date.

‡ "Vc."—The temperatures of "Vc." were, up to April 14, intermediate between those of Vc^1. and Vc. The cooled water flowed from Vc^1. into "Vc." and from the latter into Vc. "Vc." was shifted to another situation on April 14. This has not been included in summary table, p.

Lot VI.—The sixth lot of herring spawn was obtained by Mr. Thomas Smith, of the steam drifter "Integrity," K.Y. 178, while off the coast of Yorkshire. The spawn was pressed out on September 8 into a barrel containing gravel. Another opportunity of obtaining spawn occurred on September 11, and some ova were added to the same barrel. The herrings from which the spawn was procured were very small, about 8½ inches (21·5 cm.) in length. The barrel was on board till September 12. The weather was stormy, and the spawn received an "awful tossing." The water was changed in the barrel several times. The barrel was landed at Anstruther on September 12, and forwarded by rail to Aberdeen. On arrival the barrel was, by inadvertence, sent to the cold store, the temperature of which was 20° F. (−6·6° C.). Twenty hours later it was recovered from the cold store. By this time a layer of ice 2½ inches thick had formed on the top of the sea-water. The ice was removed, and the barrel was then conveyed to the Laboratory. After an interval of one to two hours the spawn was, at 3 p.m. on September 13, distributed in several hatching-boxes supplied with running sand-filtered water of a temperature of about 12° C.

The first portion of the spawn had been in the barrel for five days, and a large quantity of it was alive. The embryo was at the stage shown in fig. 10; the tip of the tail almost reached the head. Some of the eggs of the later portion of spawn were alive and in the disc stage.

On September 19 a quantity of herring fry was noticed. Some may have appeared before that date. There was a strong current of water flowing through the boxes. The temperature of the water in the pond at the Laboratory had been in the interval—September 12 to 19—at 11·6° to 13° C. That range may be taken for the water flowing in the hatchery. The fry were swimming actively right at the surface, so close to it that they continually broke the surface, causing a rather characteristic shimmer.

Some embryos showing pigmented eyes but not yet ready to hatch probably belonged to the second batch of eggs. Many of the eggs were dead; one mass consisted of dead eggs except at the edge, where one egg contained a live embryo ready to hatch. This fact would probably indicate that the mass belonged to the first portion of spawn. Many of the eggs had died before the closure of the blastopore. Some, however, had died after the embryos had developed.

There were large quantities of fry for a week after September 19. The majority of the eggs were, however, dead.

MEYER'S EXPERIMENTS.

Meyer* made some important experiments on the influence of cold on the incubation-period of the ova of the spring-herring of the Baltic (River Schlei).

"The eggs, fertilized in porcelain dishes on April 26, were kept at various temperatures; the water was changed once a day. The ova kept at 10° to 12° C. hatched in 10 to 11 days. Those that were put on arrival at Kiel into water at from 1° to 2° C., and which were kept at that temperature, hatched out in 28 to 33 days. Some were still later in escaping. Some eggs of the summer-herring had, however, been retarded to a similar extent by a temperature of 3·5° C."

"In the case of eggs kept at 0° C., the first fry appeared on the 47th day. The fry did not seem to be quite healthy, although many of them swam actively about all day long. Some of them had curved backs. Meyer, however, was of the opinion that healthy fry might be hatched at a temperature of 0° C. The limit to which cooling of the ova may be carried, without causing death, is given by Meyer, for the Baltic water, at between 1° and −0·8° C.; in either case near 0° C. In water of −0·8° C. the yolk becomes opaque and the egg-shell swells up and bursts. He found that the fry of the spring-herring, which measured on hatching 4·7 to 7·2 mm., were rather smaller than those of the summer-herring, which varied from 5·4 to 8·8 mm. In each case the eggs which had the longer incubation-period gave rise to the larger lava. The water of the Schlei when fertilization was made on April 26 had a salinity of 1 per cent. The water in Kiel harbour had about that time a salinity of 1·4 per cent."

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* Meyer—"Biologische Beobachtungen bei Künstlicher Aufzucht des Herings der westlichen Ostsee." *Mittheil. aus der Komm. zur wissenschaftl. Untersuchung der deutschen Meere.* I. Berlin, 1878.

Summary.

Table showing the Periods of Incubation for each lot of Spawn.

The average temperature over the period is obtained from the maximum and minimum observed temperatures of each day. Every temperature observation was, therefore, not made use of. The data given in the tables above are the material used. Degrees centigrade.

Lot.	Date of Fertilization.	Cooled or Uncooled.	Temperature of the Water.				Period of Incubation.	Length of Period of Incubation.
			Table, page	Range.		Average.		
				M.	m.			
	1908.							
I.	Feb. 18	Partly cooled.	106	8·3	—1·8	4	Feb. 18 to Mar. 25	29 to 35 days.
II.	,, ,,	,, ,,	106	8·3	—1·6	4·2	,, ,, ,,	,, ,,
III.	,, 19	,, ,,	106	8·7	— ·4	4·4	,, 19 ,, ,,	28 to 34 days.
Ic.	,, 18	Cooled.	108	5·6	—1·6	1·4	None hatched.	...
IIc.	,, ,,	,,	108	6	—1·6	1·4	,, ,,	...
IIIc.	,, 19	,,	108	4	—1·6	2·1	,, ,,	...
IV.	,, 29	Uncooled.	110	6·4	2·8	4·8	Feb. 29 to April 5	23 to 36 days.
IVc.	,, ,,	Cooled.	113	4·2	— ·4	1·8	,, ,, 20	46 to 51 days.
IVc.^{1}	,, ,,	,,	113	5·8	1	2·1	,, ,, 25	46 to 56 days.
IVc.^{2}	,, ,,	Partly cooled.	113	5·2	1	3·2	,, ,, 10	28 to 41 days.
V.	Mar. 5	Uncooled.	115	8·2	4·2	5·5	Mar. 5 to April 12	20 to 34 days.
Vc.	,, ,,	Cooled.	118	4·6	1	2·6	,, , 27	37 to 52 days.
Vc.^{1}	,, ,,	,,	118	4·6	·8	2·3	,, ,, 28	41 to 53 days.
Vc.^{2}	,, ,,	,,	118	7·9	·6	3·7	,, ,, 17	35 to 42 days.
VI.	Sept. 8	Partly cooled.	—	13	—6·6	...	Sep. 8 to Sep. 19 *et. seq.*	11 to * days.

* The upper limit of the incubation-period was not noted.

The experiments show that the period of incubation of the eggs of the North Sea herring may be extended to 50 days, if the eggs are kept in water of a sufficiently low temperature. From the extensive range of temperature to which the various batches of eggs were subjected, it is seen that the ova are able to withstand changes in temperature very well. A noticeable case is the last (VI.) in the table just given, where the barrel containing the spawn was suddenly plunged from the warm temperature of a September day* into a cold store at — 6·6° C. (p. 119). On the following day the ova were put into water of 12° C. Nevertheless a large quantity of the fry hatched out.

Very low temperatures, *e.g.*, below zero C0, were not often reached, but in several instances eggs which had been for a short time at temperatures of from —·4 to —1·8° C. were successfully hatched.

M'Intosh† records a striking instance of the vitality of the demersal eggs of *Agonus cataphractus*. A small bunch of the eggs of this species, which measure about 17 mm. in diameter, was obtained on October, 1894. In January and February following the eggs were frozen, and they remained so for nearly a month. Yet on the 2nd March some of the embryos were alive and were safely hatched. These eggs had therefore passed an incubation-period of 152 days at least.

The eggs of the salmon do not appear to suffer much from the temporary freezing of the water.

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* The temperature of the air at one time during the 12th September was about 15° C.

† M'Intosh—"Contributions to the Life-Histories of the Food and other Fishes: —4. On the Spawning-period of the Armed Bullhead and the Vitality of its Eggs." *Thirteenth Annual Report of the Fishery Board for Scotland* for 1894. Part III. Edinburgh, 1895, p. 230.

During the experiments the temperatures were never steady. The hatchery water was obtained from an outside reservoir, the temperature of which varied with the temperature of the air. The water pumped into the reservoir from the sea was usually at a higher temperature than the water that was standing in it. The cooled water varied also, both in consequence of the variation in temperature in the water and air of the hatchery, and also in consequence of the method of cooling. The cooling apparatus was described on p. 103. Its action depended upon the ice supplied to the tins. Between one changing of the tins and the next, the temperature quickly fell to a minimum, and then, as the ice got melted, gradually rose till it reached the maximum temperature, that was just before recharging. The temperature of the water was taken just before recharging, and again some time, about an hour usually, after that operation. The temperature was also observed at other times. Recharging was necessary twice and three times in the twenty-four hours.

The question might be asked how far a rise and fall in the temperature of the cooled water is to the advantage of the ova. Would a regular low temperature of, say, 2° C. be fatal to the eggs, while a range of which the average was 2° C. proved safe ? I think not.

There was a large mortality among the eggs. It was not, however, confined to the cooled spawn, although in some batches of these all the eggs died before hatching. Death could not be ascribed in large measure to the cooling. The main cause of the mortality was deficient aeration. This occurred through the adoption of an egg-box (fig. 102), which required a strong current of water flowing through it before a complete circulation of the water was attained. In the cases where the boxes received uncooled water, when the current was reduced the eggs began to die off. The boxes were useful for reducing the temperature of the water, since they were packed outside with ice, but the water in the lower portion of the box was noticed on several occasions to be at a less temperature than the surface portion. In this way a body of dead water existed in the box, and it offered resistance to the inflowing current of water upon which the aerating circulation depended. In one box the water at the bottom was at − 1°, while at the top it was − ·2° C. ; in another case the temperatures were 1·5° below and 2° C. on the top.

Only a small current of cooled water was available. It varied from about 1 gallon (4½ litres) in three minutes to 1 gallon in five minutes. Where the egg-boxes were used with the glass plates set in the inclined grooves, nearly all the eggs died. One of the boxes was used successfully with a plate lying horizontally near the top of the box, so arranged that the inflowing water fell on to the plate (IVc^1). In another case the box was half filled with pebbles, and some lumps of spawn were put on top of these (Vc^1). The intention in using the boxes was to get advantage of the ice jacket. A white compound formed on the surface of the metal. This may not have been of advantage.

On the whole, the most efficient aeration was obtained with the Dannevig hatching-boxes,* used as shown on p. 102. They were employed with success for the spawn on the gravel. It is not, however, so easy to keep down the temperature of the water with these, since ice cannot be applied directly. When the fry begin to hatch, moreover, the current of water eventually drives them up against the sieve bottom, *i.e.*, the outlet. It is preferable that the arrangement should allow of the fry being carried away at once by the outflow into a large rearing tank. The fry should not, in my opinion, be handled if it is possible to avoid it.

*The Dannevig hatching-box is described by Ewart in "On the Artificial Hatching and Rearing of Sea-fish." *Fifth Annual Report of the Fishery Board for Scotland* for 1886, Edinburgh, 1887, p. 230.

Where the spawn is on glass plates it is probable that a mechanical system of aeration would be most suitable. As the experiments were conducted, none of the water was used over again. If it were possible to use the cooled water a second time it would simplify the cooling arrangements, and it would be possible to give a stronger current. This would require a special small pump.

It is probable that an average temperature of 2° C. (35·5° F.) would be sufficient to prolong the incubation-period to 50 days.

Crystals Inside the Eggs.—Crystals (figs. 2, 6, 26, 49) were commonly observed in the cooled eggs and also in some uncooled eggs. It is possible that these are excretory products formed during the development of the embryo. The low temperature or the deficient water circulation may not have been helpful to the removal of the product, which had accumulated both inside and outside of the zona. The water circulation probably plays two *rôles*—the supply of oxygen and the removal of excretory products.

The Fertilization of the Egg of the Herring.

Brook[*] agreed with the conclusion of Kupffer that the formation of the perivitelline space in the egg only took place after fertilization. The envelope of the egg, when pressed out of a ripe female, is thick and sometimes bossed. When the perivitelline space has appeared the envelope is thinner and smoother.

Brook found that the ova retain their vitality 40 to 48 hours after the female is dead, but that the spermatozoa do not retain their vitality for more than three hours after the death of the fish.

A male herring was dissected on February 20, 1908, 24 hours after death. A piece of the ripe milt was put into sea-water. At first the sperms were almost motionless. Then they began to oscillate, and finally a few of them moved vigorously. They seemed to be united in groups; the tails were not made out. Their oscillations, although very marked, were not of the same nature as that of the live sperms of plaice, for example. The sperms, although apparently alive, were dead.

The Herring Fry.

The larval herring (fig. 55) is very translucent. The only pigment visible by means of the dissecting microscope is a row of 24 black corpuscles extending along the ventral edge of the muscle segments from the hind edge of the yolk-sac to the anus. There seems to be associated with them a little red pigment. A few corpuscles are visible at the end of the tail. The eye, which is silvery (reddish when seen from certain angles), has a black pupil and a black under-edge. The mouth is large, and is fixed wide-open. It is somewhat quadrangular in shape (M, fig. 54), and is underhung. The gill-arches can be faintly made out. The little fish wriggles about after the manner of an eel, and in general appearance recalls the larva hatched from the Muræenoid eggs of Raffaele.[†]

A difference in size was noticed among the fry from one of the lots of cooled spawn. The larger seemed to have the smaller yolk-sac. Meyer drew attention to a similar condition at Kiel. The larvæ hatched out in September (VI., p. 120), were rather smaller than a sample obtained from eggs hatched in April (V., *ib.*). A sample of herring fry obtained 24 miles

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[†] Brook—"On the Development of the Herring." Part II., Plates I. and II., *Fourth Report of the Fishery Board for Scotland* for the year 1885. Edinburgh, 1886, p. 31.

[*] Raffaele—"Uova gallegianti del Golfo di Napoli," *Mittheil. Zool. Station Neapel.* Bd. 8, 1888; and M'Intosh and Masterman, "The Life Histories of the British Marine Food-Fishes." London, 1897. Plate XX., fig. 6.

E. by N. of the Spurn in the beginning of October was kindly sent by Mr. James Gault, of the steam drifter "Sapphire," one of the deputation of Elginshire fishermen who attended the demonstrations at the Laboratory in April 1908. At the time the sea was very calm, and the water seemed to be mixed with sand. On drawing a bucketful the water was seen to be crowded with fry. They were still in the larval stage; a considerable part, about a half in some cases, of the yolk still remained unabsorbed. The herrings that were being caught then were in the spawning condition. A shoal of herrings had evidently spawned on this ground some short time previously. These larvæ are on the whole bigger than those hatched in September, and nearer the size of those of April. There may be a material difference in the size of the eggs of different herrings, and this circumstance may give rise to the variation in the size of the fry. Meyer found that the summer fry of the Baltic herring were larger than the spring fry.

The fry were put into various receptacles, viz., two tanks made of concrete, with glass front and back, and hatching-boxes. The tanks measured each five feet long by four feet wide by three feet deep. At first the bottom of the tank was bare except for a thin coating of mud; later on it was covered with rough sand and small gravel. The hatching-boxes had sand in them. They were usually kept floating; the water circulated outside, but there was no direct current through them. All the tanks and boxes were supplied with sand-filtered water. Some of the boxes had cooled water.

Plankton was put into the tanks, etc., from time to time. It consisted principally of diatoms, solitary and in series. During March and April the water near shore, from 5 to 7 fathoms deep, was, at the surface, much richer in diatoms than was the sea five miles off the land, where the depth was 30 fathoms and upwards. When the plankton was poured in on one occasion the fry swam about among it. It was hoped that the diatoms put into the box would breed there. Colonies of algæ grew in little bright green spots on the glass panes. They consisted of spindle-shaped diatoms. A brownish-green diatomaceous growth appeared over the bottom of the tank.

The fry hatched from the uncooled spawn was put into the ordinary water. The latter varied in temperature from 3·6° to 14·2° C. during the period March 19 to May 19. The larvæ of the cooled spawn was put mainly into uncooled water, but some was kept in cooled water. The latter varied in temperature from 1·4° to 10° C.

The fry hatched from the cooled eggs were not always very active. They were, however, observed on one occasion to be lively in water of the following temperatures:—1·4°, 2·1°, 2·3°, 2·5° C. Fairly cold water seems to suit the larvæ.

The majority of the fry died soon. This was, I believe, due to injury received in being driven about by the current of water in the hatching-boxes. The others gradually died off. Some fry were still alive in one of the tanks on May 6th. Many lived some time after the yolk was absorbed. Some which were examined had no food in their stomachs, so far as could be made out.

The fry as they hatched out each day were distributed among the various tanks, etc. It was not, therefore, possible to trace the batches of each date.

At first the fry in the various receptacles seemed to do well, as they swam actively about. A large number was put into one tank containing 2 feet of water. As Ewart* described, the larvæ swim vertically up to the surface of the water and then allow themselves to drop some distance downwards, which they do head first. Plaice larvæ in the tanks were seen to swim horizontally. A considerable number of the fry was seen lying on the smooth bottom of the tank. Some were able to rise from the bottom; others remained there and died. Some of the larvæ were curved. When they attempt to rise off the bottom, the bend in the body brings them back to their starting place. Meyer noticed that some of the larvæ hatched during his experiments at Kiel were also curved. The tank at this time had no water circulation. It had a large body of water. The circulation was dispensed with, as it was feared the fry might be carried away with the outflow. But the still condition of the water resulted in another danger. Next day many of the larvæ were floating dead on the surface. They had on swimming upwards become attached to the surface film, and had been unable to free themselves. One larva had its head opaque, while it could still wriggle its tail. A fairly violent wave motion of the water in the tank was necessary to dislodge some of the larvæ from the surface. Fry in which the yolk was absorbed also suffered death in this fashion. With a view to prevent this mode of destruction, a small jet of water playing obliquely on the surface was set up, and from time to time the water was strongly agitated. On the sixth day nearly all the fry were dead in the tank; they lay thickly spread on the bottom.

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* *Op. cit.*, p. 72.

The herring fry generally kept, attracted by the light, to the pane next the window. They wriggled up and down over the glass in a lively fashion, stopping now and then over the diatom patches as if browsing (?). When, however, they were examined by means of a lens through the glass front no food was made out in the alimentary canal. Sometimes the fry was observed collected in a shoal along the bottom of the pane; some were continually rising to sink again. The light seemed to be an irresistible attraction to the fry; it is therefore possible that a side light is not an advantage in a rearing tank. Amphipods appeared regularly in the tank. They did not get in by the water supply; they must have come up the drain. They groped their way blindly among the fry collected at the foot of the glass front, but, while scattering them, they were not noticed to catch any of the larvæ. In April the amphipods, which were diagnosed by Dr. Scott as *Orchestia littorea*, were to be found in numbers on the floor of the tank-house and in the engine-house, while outside in the yard they were very common beneath pieces of wood. They made their way up the drain into a perfectly dry tank. They were always removed when they appeared in the rearing tanks.

In a second tank a layer of sand and gravel was put on the bottom. The surface was thrown into rolls and irregularities with a view to helping the fry to rise off the bottom. The pane next the window was covered with a heavy blind. A gentle agitation of the water was secured by means of a small water-wheel. The sand on the bottom acted as a means for preventing the escape of the fry by the outflow. Some time after this tank was set in operation a number of dead fry were seen sunk in the sand next the glass. They had apparently burrowed their way downwards into the sand. This happened at a part of the tank far away from the outflow.

On April 13 a number of the larvæ had the yolk all absorbed.

The fry from the cooled spawn did just as well in the cooled water as in the uncooled. Three were alive on May 11, but they were very weak.

The want of suitable food was probably the cause of the failure to rear the fry.

Meyer succeeded in rearing the fry at Kiel.

The Transport of Living Adult Herrings.

Some herrings were sent at the beginning of March from Anstruther to Aberdeen in closed barrels. Most of them arrived alive. In one lot seven out of ten were still able to move about. They had been captured in a drift-net from 14 to 16 hours previously. None lived more than two days after arrival. They had usually lost a considerable number of scales. The water in the barrel on March 5 was, on arrival at the Laboratory, 4·2° C.

EXPERIMENTS ON THE PELAGIC EGGS OF THE HADDOCK (*Gadus æglefinus*) AND OF THE PLAICE (*Pleuronectes platessa*).

The haddock and plaice eggs were spawned naturally at the Laboratory. The eggs of both species were collected on April 22. On the following day they were put into a small wooden box which had a sieve bottom. This box was placed in a metal egg-box (see p. 102), and the latter was jacketted with ice. A small trickle of water flowed into the wooden box. On each occasion when the temperature was taken the water was gently stirred with the thermometer.

On May 3 the eggs were floating, and on May 11 the eggs of both species were seen to tend to stick to one another, more especially in the case of the eggs of the haddock. The eggs of the plaice were at a stage near the closure of the blastopore.

On May 21 two plaice fry were obtained, and on May 24 several dead fry of plaice and haddock were observed. The larvæ were in both species quite characteristic. One haddock egg had a fully-developed embryo in which the heart was beating slowly. Some plaice eggs were floating, but no haddock eggs. Some of the eggs of the latter were lying on the bottom dead.

On each of the dates, May 28, 29, and June 1, some live plaice larvæ were taken from the box.

June 2.—Twenty-eight live plaice fry were removed. Three live plaice eggs were seen. Two plaice fry were found on June 3, and the same number on June 5. On June 6 the box was emptied. No live haddock eggs were found. One dead haddock larva was noticed. One plaice larva, and a live plaice egg hatching, were the sole survivors.

The plaice eggs had hatched after an incubation period of 27 to 43 days. An egg of the haddock was observed alive and unhatched after 30 days.

The temperature of the water during the experiments is given in the table on p. 126. Some plaice eggs were incubated between layers of felt moistened by (*a*) the uncooled water of the hatchery and (*b*) by cooled water. The layers of felt were packed in the bottom of a metal cylinder in the case of (*a*) and in a wooden box for (*b*). The water was free to escape from the felt.

The experiment was started on April 29 with eggs collected on the previous day.

On May 20 the uncooled eggs were examined, *i.e.*, 21 days after the initiation. Some dead larvæ and some dead unhatched eggs were found.

The water supplied to the cooled ova was that which came from the cooled experiment of the haddock and plaice eggs. The temperatures would therefore be nearly those given in the table, p. 126.

On May 22 the cooled eggs were examined. Three dead larvæ were found. One larva was hatching. Some live eggs ready to hatch were present, and some dead unhatched eggs. The eggs were put into ordinary water. Some floated ; others sank to the bottom.

On May 28 several larvæ had hatched : the remaining eggs were dead.

The object of the above experiments was attained when the larvæ hatched. The conditions were not suitable for the fry surviving.

Reibisch* maintained that the number of days in the period of incubation multiplied by the average temperature was a constant in each species. The number of degrees centigrade was reckoned from a temperature at which development no longer took place. This temperature was for *Pleuronectes platessa*, -2·4° C. *Vide* also Apstein.*

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* "Ueber den Einfluss der Temperatur auf die Entwickelung von Fisch-Eiern." *Wiss. Meeresuntersuch. Komm. Kiel u. Helgoland.* N.F. 6 Bd. Kiel Abtheil. 1902. P. 215.

Temperature of the Cooled Water in which the Eggs of the Haddock and Plaice were kept. Degrees centigrade.

Date.	M.	m.	Date.	M.	m.	Date.	M.	m.
Apr. 23	3	2·6	May 8	2·3	0	May 23	5	0
,, 24	2·6	1	,, 9	2·3	0	,, 24	2·8	0
,, 25	2·4	·6	,, 10	2·2	. .	,, 25	3·9	0
,, 26	5·6	0	,, 11	6·7	0	,, 26	3·9	0
,, 27	3·4	·6	,, 12	2·8	0	,, 27	4·5	0
,, 28	4	·6	,, 13	1·7	0	,, 28	3·4	0
,, 29	4·5	0	,, 14	2·3	0	,, 29	3·4	0
,, 30	4·8	−·6	,, 15	1·7	0	,, 30	3·4	0
May 1	4·5	0	,, 16	3·8	0	,, 31	3·4	0
,, 2	2·8	0	,, 17	3·4	0	June 1	5·6	0
,, 3	. .	·6	,, 18	3·4	0	,, 2	5	0
,, 4	4·5	−·6	,, 19	9·5	·5	,, 3	5	0
,, 5	5·6	0	,, 20	3	·4	,, 4	5·6	·6
,, 6	2·8	0	,, 21	·6	·2	,, 5	5	1·2
,, 7	2·8	0	,, 22	5	1	,, 6	3·9	1·2

Dannevig† kept the eggs of the haddock in still water, refreshed daily, at a temperature of −1°C. for 35 days. They were then transferred to water of 6°C., in which they hatched in about two and a half days. He concluded that the development of fish eggs takes place at temperatures below zero, when the specific gravity of the water is sufficiently high to prevent it from freezing. Sea-water of a specific gravity of 1027 freezes at about −2°C. Dannevig transferred some haddock fry from the water of 6°C. in which they were hatched, some directly into water of 0°C., others into water of 10°C., without their apparently suffering. Immediately after transference they appeared quiet and inactive, but they soon again showed their usual activity and vigour. It occasionally happened that eggs kept in water of the low temperature of −2°C. became inclosed in lumps of ice that floated at the surface. When these melted, while the bottle remained quiet a layer of fresh water was found floating on the top of the sea-water. All the eggs were then seen floating exactly at the same level—at the limit between the fresh and the sea-water. The eggs of the plaice and haddock appeared to be most capable of resisting these changes. The eggs of whiting gradually succumbed: the eggs of the cod were, as a rule, the least hardy amongst them all.

Experiments on Turbot (*Bothus maximus*, Will.)

Two turbot measuring respectively 6¼ inches and 9½ inches in length were kept for a short time in June in cooled water. They were put into a tin box measuring 18 inches in length by 10¾ inches in breadth by 8¼ inches in depth. It was kept nearly full of water, and was surrounded by a jacket of ice. The water entered at the surface and escaped from the bottom. The quantity of water passed through the box was 1 gallon (4½ litres) in 32 minutes. The bottom of the box was covered with sand. In the first case the smaller fish was confined in the tin for three days. On the first day the temperature fell from 7° to 3°C. Next day the temperature at noon was 1·2°, on the third day the temperature varied from 1·7° to −·6°, and on the fourth day up till 4 p.m. the temperature was from ·6 to −1·2°C. It was alive on the third day at 4 p.m., at which time the water was at −·1°C. On the following day at 11 a.m. the fish seemed dead. No breathing action was made out, but its body was soft; it was not in rigor. During the day, however, it did not shift its position. When examined next day it was clearly dead: there was some slime on the gills. Shelled mussels had been supplied to the fish, but it had eaten none.

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* "Die Bestimmung des Alters pelagisch lebender Fischeie." *Mitteil d. deutschen Seefischerei-Vereins.* Nv. 12. 1909.

† Dannevig—"The Influence of Temperature on the Development of the Eggs of Fishes." *Thirteenth Annual Report of the Fishery Board for Scotland* for 1894. Part III. Edinburgh, 1895, p. 147.

The second turbot was put into water of 12·4°C. at 11 a.m., and the cooling process was then commenced. At 1 p.m. the temperature had fallen to 4·6°. The fish was not breathing strongly. At 8 p.m. the water registered 3·3°. On the second day up till 8 p.m. the water had varied in temperature from 3·4° to 1·7°. The turbot was alive, but during the day I was not able to detect, through the water, any movement of the gill-cover. It appears that the cold paralyses the muscles and breathing apparatus. If continued too long the fish will probably die through asphyxiation. On the third day at 10 a.m the temperature of the water had risen to 7°. From the previous night the temperature had ranged from 2·3° to 7°. The turbot was alive. No food had up till now been offered the fish. Two pieces of mussel were now put into the box. The water gradually warmed up. On the fourth day the water was at 10°. The turbot was alive. It had not eaten the mussels, and it was returned to one of the tanks from which it had been taken for the experiment. I have no further data for this fish.

EXPLANATION OF PLATE I.

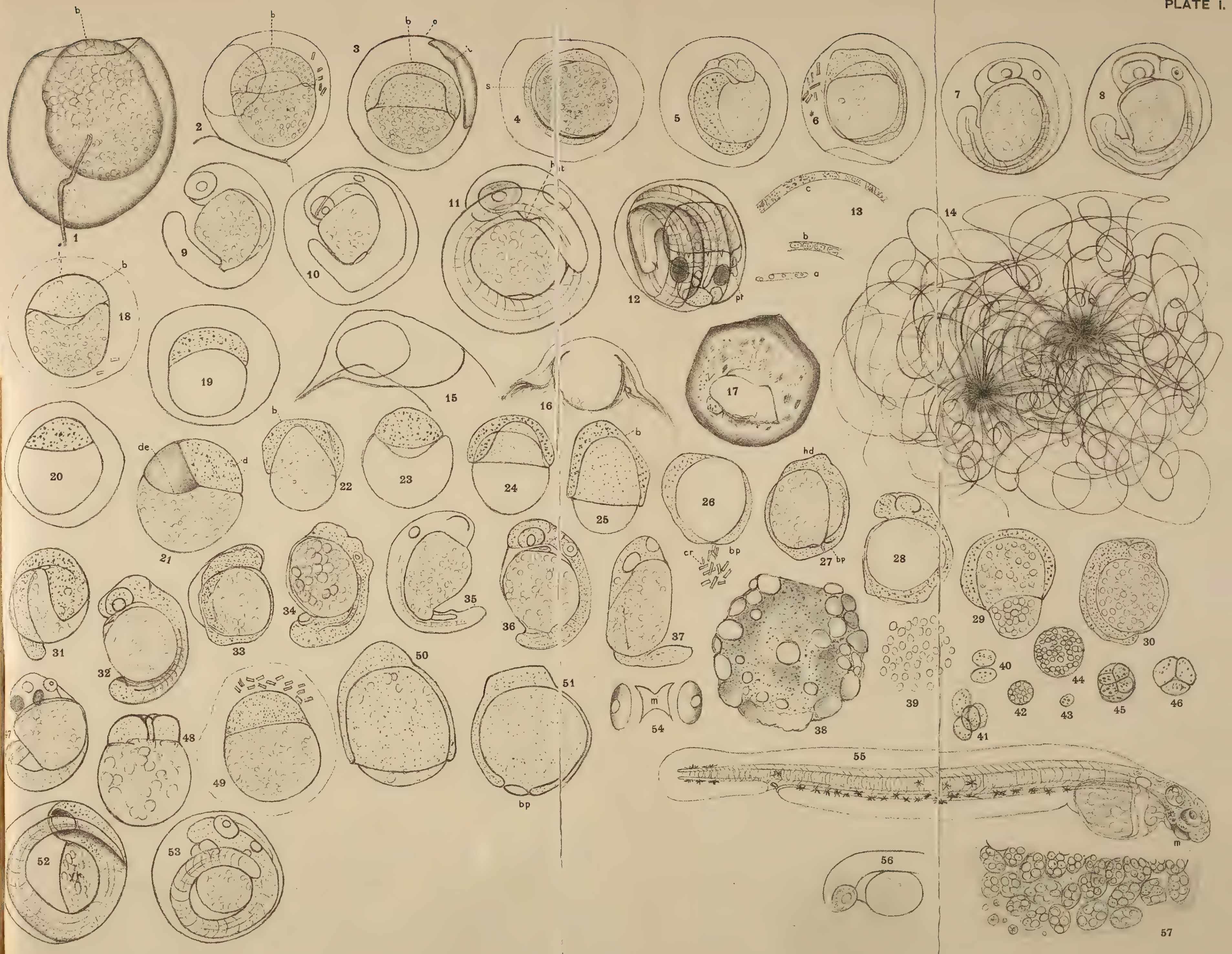
FIG. 1. Egg of Lot III. of Herring Spawn, 20th Feb. 1908 . . . × 19
,, 2. ,, I. ,, 22nd ,, ...
,, 3. ,, II. ,, ,, ,, ... × 19
,, 4. ,, I., II., and III. of Herring Spawn, 23rd Feb. 1908 . × 19
,, 5. ,, I. of Herring Spawn, 25th Feb. 1908.
,, 6. ,, II. ,, ,, ,,
,, 7. ,, I. ,, 2nd March 1908.
,, 8. ,, II. ,, ,, ,, ,,
,, 9. ,, III. ,, ,, ,, ,,
,, 10. ,, I. ,, 4th ,, ,,
,, 11. ,, I. ,, 11th ,, ,,
,, 12. ,, I. ,, 16th ,, ,,
,, 13. Hyphæ of Fungus on Herring Spawn, 27th March 1908.
,, 14. Fungus on Herring Spawn, ,, ,,
,, 15. Head of Embryo of Lot I. of Herring Spawn, 25th Feb. 1908
,, 16. ,, ,, ,, ,, Seen in Optical Section.
,, 17. Empty Egg-capsule, ,, ,, 27th March 1908.
,, 18. Egg of Lot Ic. of Herring Spawn, 21st Feb.,—*d.* blastodisc . . × 19
,, 19, 20. Eggs of Lot IIc. of Herring Spawn, 24th Feb. 1908 . . . × 19
,, 21. Cooled Eggs of Herring Spawn, 24th Feb. 1908, showing depression (*de*) between the blastodisc and the yolk.
,, 22. Egg of Lot Ic. of Herring Spawn, 26th Feb. 1908 . . . . × 19
,, 23. ,, IIc. ,, ,, ,, ... × 19
,, 24. Eggs of Lots IIc. and IIIc. of Herring Spawn, 26th Feb. 1908.
,, 25, 26. Eggs of Lot IIIc. of Herring Spawn, 26th Feb. 1908—*bp.* blastopore, *cr.* crystal.

Fig. 27. Egg of Lot Ic. of Herring Spawn, 2nd March 1908—*bp.* blastopore, *hd.* head.
,, 28. Egg of Lot IIIc. ,, ,, ,,
,, 29. ,, IIc. ,, 3rd March 1908.
,, 30. ,, Ic. ,, 5th ,, ... × 19
,, 31. ,, IIIc. ,, ,, ,, ... × 19
,, 32, 33. ,, Ic. ,, 9th ,,
,, 34. ,, Ic. ,, 11th ,,
, 35. ,, IIIc. ,, ,, ,,
,, 36. ,, Ic. ,, 13th ,,
,, 37. ,, IIIc. ,, 19th ,,
,, 38. ,, Ic. ,, 24th ,, Dead egg. It has white granular masses on its exterior.
,, 39–46. Enlarged views of the Organisms comprising the white patches shown in Fig. 38.
,, 47. Egg of Lot Ic. of Herring Spawn, 10th April 1908.
,, 48. ,, IVb. ,, 29th Feb. ,,
,, 49. ,, IVc. ,, 5th March ,,
,, 50. ,, ,, ,, 11th ,,
,, 51. ,, ,, ,, ,, ,, *bp.* blastopore.
,, 52. ,, ,, ,, 9th April 1908.
,, 53. ,, IVc^2. ,, 18th March 1908.
,, 54. Mouth of Larva of Herring just hatched.
,, 55. Larva of Herring just hatched, 19th March 1908 . . . . . × 19
,, 56. Head of Larva just released from the Egg, p. .
,, 57. Portion of one of the white granular masses shown in Fig. 38. Magnified.

Letters Used in Plate I.

b.—blastodisc.
bp.—blastopore.
cr.—crystal.
de.—depression between the blastodisc and the yolk.
hd.—head.
ht.—heart.
i.—inner investment.
o.—outer ,,
pt.—protoplasm point on periblast.

PLATE I.



H. C. W.

HERRING (*Clupea harengus*).

V.—A REVIEW OF THE FISHERY STATISTICS FOR SCOTLAND.

By Dr. T. Wemyss Fulton, F.R.S.E., Scientific Superintendent.

Since the establishment of the Fishery Board in 1882, the annual Reports have contained a large and important series of statistical tables referring to the sea fisheries of Scotland. In the present paper those which refer to certain subjects, namely, the quantity and value of the fish and shell-fish landed in each year, have been collated and discussed, and certain conclusions have been drawn from them as to the increase or decrease of a particular kind of fish, in quantity or value, or in relation to the methods of capture. The statistics are published in the Reports of the Board in relation to the fishery districts—that is to say, the divisions of the coast into areas according to the requirements of the fisheries in the localities; and in dealing with them they have been arranged in the three great divisions —the East Coast, comprising fifteen fishery districts, from Eyemouth to Wick, and embracing the north as well as the east coast of Scotland; the West Coast, comprising ten fishery districts, including the western islands; and the Orkney and Shetland Isles, which are grouped separately.

Some of the statistics go back to the year 1883, and those referring to the shell-fish have been extracted and tabulated from that year. From the year 1889 statistics were published giving the quantity and value of the most of the fishes landed on each coast separately, and the aggregate quantity and value, and it is from this year that the tables appended, which deal with the fish as distinguished from the shell-fish, begin. A few years later, in 1892, a further improvement was made, inasmuch as the quantity and value of the fish taken in the three great kinds of fishing—line-fishing, trawling, and net-fishing—were separately recorded. From that year, therefore, it has been possible to make a comparison as to the development or retrogression of these various methods of fishing in relation to Scotland as a whole and in relation to the different coasts.

The main lessons to be drawn from a study of the statistics are that, on the whole, very satisfactory progress has been made in exploiting the sea fisheries; that within the period a marked change has taken place as to the relative positions of line-fishing and trawling with regard to the supply of bottom or demersal fishes; and that the great fishery for herrings has, in late years especially, been very considerably developed. A gross increase of 26 per cent. in the quantity of fishes landed in the second half of the period covered by the statistics, compared with the first half, is very satisfactory, and the value has increased in still greater ratio. The progress or development has, however, been much more marked on the East Coast and the Orkney and Shetland group than on the West Coast, where, indeed, although the value of the fish landed slightly increased, the quantity diminished.

It has to be borne in mind that in the period covered by the statistics great changes have taken place with respect to the fishing grounds visited. The quantities landed in different years by no means represent the yield of the same grounds, since fishing vessels now visit distant quarters to obtain their supplies of fish. Nor do the quantities in any particular year represent the same amount of fishing power expended. On both these points special information in connection with the statistics is required, and is now being obtained.

THE QUANTITIES OF FISH LANDED.

Considering first the grand totals of the fish landed, of all kinds and by all methods of fishing, the tables show that the aggregate quantity in the twenty-one years, 1888–1908, amounted to 134,561,059 cwts., or an average of 6,407,669 cwts. per annum over the whole period. The greater part of this belongs, however, to the later years. Thus, if two periods of ten years each are taken, the first including the years 1888–1897 and the second the years 1899–1908, it will be found that the aggregate quantity of fish landed in the former amounted to 56,609,420 cwts., or an average of 5,660,942 cwts. per annum, while in the latter period the quantity was 71,393,871 cwts., the average per annum being 7,139,387 cwts., indicating an increase of about 26 per cent. When the quantities for each successive year are studied, as by means of graphic diagrams, the rise in the aggregate is very obvious from the year 1899 onwards. In only one of the fourteen years before 1902 was the general average for the twenty-one years exceeded (in 1898); in all the later years that average was exceeded. If the extreme years of the series, 1888 and 1908, are contrasted, the increase brought out amounts to about 87 per cent.

Up to the year 1892 particulars are not furnished as to the method of fishing by which the fish were taken. But from that year on the fish landed are summarised under the headings of line-caught fish, trawl-caught fish, and net-caught fish. The two first-named groups comprise fish which live upon or near the bottom of the sea, and are commonly designated demersal fish; they include round fishes, as cod, haddocks, ling, etc., all kinds of flat-fishes, and skates and rays. The net-caught fish comprise those taken mostly by drift-nets, and include the herring—which is by far the most important in these statistics—the mackerel, and the sprat, and this group is usually called pelagic fishes. In the tables, sparlings (*Osmerus eperlanus*) are included with the pelagic fishes, but the quantities are so insignificant that they may be neglected in considering the totals of the net-caught fish.

The quantity of demersal fish taken, whether by line or trawl, in the seventeen years, 1892–1908, amounted to 36,442,218 cwts., or an average of 2,143,660 cwts. per annum, and the total quantity formed a little over 32 per cent. of the whole of the fishes landed. In the first eight years of the period, 1892–1899, the aggregate quantity of demersal fishes landed by liners and trawlers was 15,252,579 cwts., the average per annum being 1,906,572 cwts.; in the last eight years, 1901–1908, the quantity was 19,355,141 cwts., the average per annum being 2,419,393 cwts., or an increase amounting to about 27 per cent. Contrasting the extreme years of the series, 1892 and 1908, the increase amounted to about 64 per cent. Study of the figures for successive years shows that the quantity of demersal fishes landed gradually rose from 1892 to 1896, when it was 2,143,947 cwts.; it then slowly fell, with but slight fluctuation, to 1900, when it was 1,834,498 cwts.; since then it has gradually and steadily risen to 1908, when it amounted to 2,900,811 cwts. In the first period, 1892–1899, the percentage of bottom fishes to the total fishes landed amounted to about 33 per cent.; in the second period, 1901–1908, it was about 32 per cent. Thus, while the quantity of those fishes taken by the line and the trawl has increased absolutely and considerably, it has barely maintained its position in relation to the other class, the pelagic fishes, which means substantially the herring.

The tables show that, of the two methods of fishing by which the demersal fishes are taken, the greater quantity was caught by the line up to the year 1899, when the line and the trawl contributed about half of the total. After that, however, the quantity taken by the trawl steadily and continuously rose, while the quantity taken by line diminished, but with some fluctuation. Since 1904 the quantity taken by line has remained fairly steady, and the quantity in 1908 was the largest since the year 1899; this has come about by the development of steam-lining. At the beginning of the period, in 1892, the line contributed about 78 per cent. of the demersal fishes landed and the trawl about 22 per cent.; at the end of the period, 1908, the positions were reversed, the trawl contributing about 73 per cent. of the total and the line about 27 per cent. In the first eight years, 1892–1899, the quantity of demersal fishes taken by line was 10,551,384 cwts., the average per annum for the period being 1,318,923 cwts., while the total taken by trawl was 4,701,195 cwts., and the average per annum was 575,149 cwts. In the years 1901–1908, on the other hand, the total quantity taken by line amounted to 5,488,644 cwts., the average per annum being 686,080 cwts., whereas the quantity caught by trawl was 13,866,497 cwts., and the average per annum 1,733,312 cwts. Thus the contrast of these two periods shows that while the quantity of fish taken by line decreased by 48 per cent., the quantity taken by trawl increased by about 195 per cent. Comparing the first and the last single years of the period, 1892 and 1908, the fish taken by line had diminished by 598,895 cwts., or about 43 per cent., while the fish taken by trawl had increased by 1,731,754 cwts., or about 456 per cent.

The pelagic fish, as described above, show even a greater ratio of increase as landed than the bottom fishes do. In the seventeen years, 1892–1908, the aggregate quantity was 76,597,806 cwts., or an average of 4,505,753 cwts. per annum, and they formed nearly 68 per cent. of the whole of the fishes landed. Comparing again the first period of eight years, 1892–1899, with the second period, 1901–1908, the tables show that in the former the quantity landed amounted to 31,538,650 cwts., with an annual average of 3,942,331 cwts., while in the latter the quantity was 41,524,389 cwts., the annual average being 5,190,549 cwts., showing an increase of about 31 per cent. In the first eight years they formed about 67 per cent. of the total quantity of fishes landed, and in the last period of eight years about 68 per cent. The toll taken from the surface-swimming fishes, while always greater absolutely, has also been relatively larger in recent years than the toll taken from the bottom-living fishes. A study of the figures for successive years shows that the fluctuations in the case of the pelagic fishes, as was to be expected from their habits and conditions of life, are greater absolutely and relatively than in the case of the demersal fishes. Owing also to their predominance in composing the total of the fishes landed, the fluctuations in the latter are chiefly determined by the fluctuations of the pelagic fishes. What was said above as to the aggregate of fishes applies also to the net-caught fish.

It is necessary to consider also the figures referring to the fishes landed on the various coasts. The fishery districts are grouped into three divisions—(1) those on the East Coast, (2) those comprising Orkney and Shetland, and (3) those included in the West Coast.

East Coast.

During the twenty years from 1889 to 1908 the gross quantity of fish of all kinds landed on the East Coast of Scotland amounted to 85,494,243 cwts., or an average per annum for the whole period of 4,274,712 cwts. For the first ten years, 1889–1898, the aggregate was 40,460,768 cwts., or an average of 4,046,077 cwts. per annum; for the second ten years the aggregate was 45,033,475 cwts., or an average of 4,503,347 cwts. The increase in the last period was thus 11 per cent. Comparing the figures for the first year, 1889, and the last year, 1908, the increase amounted to 30 per cent. The lowest years were 1897, 1899, and 1890, with totals but little over 3,000,000 cwts.; the highest years were 1907 and 1908. The curve formed by the figures for the successive years shows fluctuations up and down during the first period, and a fairly steady and considerable rise from 1900 onwards. This rise was due in the greater part to the increase in the pelagic fish (herring), but also not a little to the increase in the trawled fish.

The aggregate quantity of line-caught fish landed in the seventeen years, 1892–1908, amounted to 11,080,088 cwts., an average per annum of 651,770 cwts. In the first eight years of that period, 1892–1899, the quantity was 7,032,609 cwts., the average per annum being 879,076 cwts.; in the last eight years the aggregate was 3,599,003 cwts., the average per annum being 449,875 cwts. The decrease thus amounted to nearly 49 per cent. when the two periods are contrasted. The decrease when the figures for 1892 are compared with those for 1908 amounted to barely 44 per cent. A study of the figures for the various years shows that from 1893 to 1896 there was a steady and fairly uniform rise in the quantity of line-caught fish landed, the quantity in the latter year being 1,097,736 cwts.; but from 1896 to 1902 there was a rapid decline, the quantity dropping to 405,030 cwts., while since then there has been a tendency for a moderate rise in the quantity, with, however, a good deal of fluctuation.

The most noteworthy feature in the statistics of the East Coast fisheries during the period under review was the development of steam trawling. The increase in the quantity of trawl-caught fish has thus been very great. In the seventeen years the total quantity of trawled fish landed on the East Coast was 19,294,391 cwts., the average per annum being 1,134,964 cwts. But in the first eight years of the period the quantity amounted to only 4,639,260 cwts., giving an annual average of 579,907 cwts., whereas in the last eight years the quantity was 13,595,970 cwts., and the annual average 1,699,496 cwts. The increase, comparing period with period, was thus about 193 per cent. Comparing the figures for 1892 and 1908, the increase amounted to 447 per cent., the respective quantities being 375,043 cwts. and 2,051,586 cwts. The increase in the trawl-caught fish has been practically uniform and regular throughout the period. Starting in 1892 considerably below the level of the line-caught fish, it began to exceed it first in 1898. In 1892 the trawled fish represented 29 per cent. of the total demersal fish landed on the East Coast, whereas in 1908 they represented 80 per cent.

During the seventeen years the aggregate of the demersal fish landed by line and by trawl amounted to 30,374,479 cwts., an average per annum of 1,786,734 cwts. In the first eight years, 1892–1899, the quantity was 11,671,869 cwts., and the annual average 1,458,984 cwts.; in the last eight years, 1901–1908, the quantity was 17,194,973 cwts., and the average per annum 2,149,372 cwts. The increase, comparing one period with another, was thus about 47 per cent. In the year 1892 the aggregate amounted to 1,288,248 cwts., while in 1908 the aggregate was 2,563,764 cwts., an increase of 99 per cent. If the quantities of demersal fish are contrasted with the quantities of pelagic fish, the following results appear. In the whole period the pelagic fish amounted to 59 per cent. and the demersal fish to 41 per cent. of the whole. In the first period, 1892–1899, the pelagic was 63·6 per cent., while the demersal was 36·4 per cent. of the whole for that period. In the last eight years the pelagic was 55·8 per cent. and the demersal 44·2 per cent. of the total. We thus see that on the East Coast the demersal fish have increased in greater ratio than the pelagic.

The total quantity of the pelagic fish taken in the seventeen years amounted to 43,634,580 cwts., or an annual average quantity of 2,566,740 cwts. In the first eight years the quantity was 20,401,620 cwts., the annual average being 2,550,202 cwts.; in the last eight years the quantity aggregated 21,694,946 cwts., the average per annum being 2,711,868 cwts.

The increase was thus small, amounting to about 6 per cent. when the two periods are compared.

Orkney and Shetland.

The aggregate quantity of fish landed in these islands in the twenty years, 1889–1908, amounted to 24,634,278 cwts., or an annual average of 1,231,714 cwts. The quantity landed in the ten years, 1889–1898, was 7,259,991 cwts., the average per annum being 725,999; in the last ten years, 1899–1908, the quantity was 17,374,287 cwts., the annual average being 1,737,429 cwts. There was thus an increase of 139 per cent. in the latter period.

In the period 1892–1908, in which the methods of fishing are distinguished, the aggregate was 22,909,325 cwts., and the annual average 1,347,607 cwts.

The total of the demersal fish landed in that period amounted to 2,778,496 cwts., the annual average being 163,441 cwts. Of this quantity 2,578,985 cwts. were taken by line, and 199,511 cwts. by trawl. In the eight years 1892–1899 the quantity taken by line was 1,670,476 cwts., the annual average being 208,809 cwts.; in the last eight years the quantity was 776,217 cwts., or an average of 97,027 cwts. per annum. There thus occurred a decrease of 53 per cent. in the line fish between the two periods. The landings of trawled fish appear to have been irregular in the earlier years, the first notification of them being in 1894. The total to 1908 amounted to 199,511 cwts. In the first eight years the quantity was 21,435 cwts., the yearly average being 2,679 cwts.; in the last eight years of the period the quantity was 164,073 cwts., the average per annum being 20,509 cwts. There was therefore an increase of trawled fish to the extent of 665 per cent. The proportion to the other classes of fish is, however, inconsiderable.

The quantity of pelagic fish landed in the seventeen years amounted to 20,130,839 cwts., the average per annum being 1,184,167 cwts. In the eight years, 1892–1899, the quantity was 4,920,678 cwts., the average per annum being 615,085 cwts.; in the years 1901–1908 the aggregate was 14,054,054 cwts. and the average 1,756,757 cwts., an increase of 9,133,376 cwts., or 186 per cent. This is the outstanding feature of the fishery statistics for the region, and it contrasts with the comparatively small increase on the East Coast of Scotland. In the first period, 1892–1899, the proportion of demersal to pelagic fish was 25·6 per cent., but in the second period it sank to 6·3 per cent., the pelagic representing 93·7 per cent. of the fish landed.

West Coast.

In the twenty years the aggregate quantity of fish landed on the West Coast amounted to 19,799,428 cwts., the average per annum for the period being 989,971 cwts. In the first ten years the total was 10,813,319 cwts., the average per annum being 1,081,332 cwts. In the last ten years of the period the total quantity was 8,986,109 cwts., the annual average being 898,611 cwts. There was thus in the second period, contrasting with the condition on the East Coast, a considerable decline, amounting to 1,827,210 cwts., or nearly 17 per cent.

The quantity of bottom or demersal fish landed in the seventeen years 1892–1908, both by line and trawl, amounted to 3,292,664 cwts., giving an annual average of 193,686 cwts. In the eight years 1892–1899 the total of these fishes was 1,892,210 cwts., the average being 236,526 cwts. per annum; in the eight years 1901–1908 the total was 1,219,888 cwts., and the average 152,486 cwts. There was thus a decrease in the latter period of 672,322 cwts., or above 35 per cent., in the demersal fishes landed.

The decrease was in the fish taken by line. The quantity of the line-caught fish in the first period was 1,851,713 cwts., the average being 231,464 cwts., whereas in the eight years 1901–1908 the quantity was 1,113,434 cwts., the average per annum being 139,179 cwts. There was thus a decrease of about 40 per cent. in the quantity taken by line, which is rather under the percentage decrease in the line-caught fish on the East Coast in the same period. On the other hand, the trawl-caught fish, though not of the same importance as on the East Coast, also increased in quantity in the second portion on the West Coast. In the first period, 1892–1899, the total amounted to only 40,497 cwts., the annual average being 5,062 cwts. In the years 1901–1908 the quantity was 106,454 cwts., and the average 13,307 cwts. There was thus an increase of 65,957 cwts., or about 163 per cent. But the proportion of the trawl-caught fish landed on the West Coast is still much under that of the line fishing, thus contrasting with the condition on the East Coast, as shown above.

The class of pelagic fish, which means essentially herring, is the great one on the West Coast, although here also one finds a decrease rather than an increase over the period covered by these statistics. In the seventeen years the aggregate quantity landed amounted to 12,828,971 cwts., the average being 754,645 cwts. In the first period, 1892–1899, the quantity was 6,212,936 cwts., and the average per annum 776,617 cwts.; in the period 1901–1908 the total was 5,775,389 cwts., and the average 721,924 cwts. There was thus a decrease of about 7 per cent. The decrease in this class is, however, relatively less than that among the demersal fish, for in the first period the proportion was 23·3 per cent. demersal fish and 76·7 pelagic, whereas in the second period the proportion was 17·4 demersal and 82·6 pelagic.

The above description is limited to the great classes of fishing and the totals of all kinds of fish landed. It is necessary now to refer to the different fishes themselves and to see how they have varied during the period covered by the statistics.

East Coast.

Pelagic Fish.—By far the greater part of the group included under this term consists of herring; in 1908, for example, they represented 99·1 per cent. of the total, and in the ten years 1899–1908 they represented 99 per cent., while sprats represented 0·9 per cent. and mackerel only 0·1 per cent. The aggregate quantity of herrings landed on the East Coast in the twenty years, 1889–1908, amounted to 50,629,474 cwts., giving an average per annum for the period of 2,531,474 cwts. From a comparison of the two ten-year periods it appears that rather less herrings have been taken in the second period than in the first. In the years 1889–1898 the aggregate quantity was 26,134,400 cwts., the average per annum being 2,613,440 cwts.; in the period 1899–1908 the aggregate quantity was 24,495,074 cwts., and the annual average 2,449,507 cwts. The decrease thus amounted to 6 per cent., comparing one period with another. It was in the main due to poor years in 1899, 1900, and 1901, when the quantities were below 2,000,000 cwts. This is indicated in the grouping of the figures in quinquennial periods, as follows:—

Years.	Cwts.	Years.	Cwts.
1889–1893....	2,641,906	1899–1903....	2,019,785
1894–1898....	2,584,974	1904–1908....	2,879,230

The highest year in the period was 1907, with 3,773,624 cwts.; the next best was 1893, with 3,158,346 cwts.; the lowest was 1897, when the total amounted to 1,503,693 cwts. The first year, 1899, and the last, 1908, were much the same, the former having 2,850,925 cwts. and the latter 2,881,419 cwts.

The sprat fishing is but of little importance except in one or two places. The aggregate quantity of sprats landed in the twenty years was 402,066 cwts., the annual average being 20,103 cwts. In the ten years 1889–1898 the quantity was 180,223 cwts., the average per annum being 18,022 cwts.; in the ten years 1899–1908 the total quantity was 221,843 cwts., the annual average being 22,184 cwts. There was thus an increase in the second period of 23 per cent. The fluctuations in the case of this fish were excessive, the quantities ranging from 4214 cwts. in 1889 and 5379 in 1891, to 60,438 cwts. in 1903 and 58,315 cwts. in 1893.

It is stated above that among the pelagic fishes landed on the East Coast of Scotland mackerel constitute only a small fraction per cent., a proportion much below what the relative numbers of the fish in the sea would justify, and below the proportion of other countries bordering the North Sea. The aggregate quantity landed in the twenty years was only 34,544 cwts., giving an average of 1727 cwts. per annum. In the first ten years the total was only 4156 cwts., the annual average being trifling, viz., 416 cwts. In the second period, 1899–1908, the total amounted to 30,388 cwts., with an average per annum of 3039 cwts. There was thus a considerable increase, namely, 631 per cent. It is, indeed, only in recent years that the fishery has been developed, as is apparent from the fluctuations in the quantities in different years. In 1889 only 33 cwts. were landed, whereas in 1905 the quantity was 6004 cwts. It has fallen a little since then, the amount in 1908 being 4539 cwts. In quinquennial periods the following shows the average per annum:—

Years.	Cwts.	Years.	Cwts.
1889–1893........	130	1899–1903......	1538
1894–1898........	701	1904–1908......	4540

The great bulk of the mackerel were taken by net, and chiefly the drift net, but of late years a fair quantity have been captured by trawlers, viz., 1033 cwts. in 1906, 669 in 1907, and 387 in 1908.

Round Fish.—From the year 1892 onwards a section of the statistics deals with "round fish," but owing to changes at various times in the classification the figures are not comparable throughout. Thus in 1892 and up to 1904 this class was confined to cod, ling, tusk, saithe, haddock, whiting, and conger eel; in 1904 and since, gurnard, catfish, angler, and hake were included, these species having previously been placed among the "unclassified" fish. In the table on p. 169 the totals are given, and also the quantities which were caught by the three methods of fishing—line, trawl, and net. From 1889 to 1903 inclusive, the totals may be taken as representing the round fishes landed, and in these fifteen years the aggregate amounted to 19,378,464 cwts., the average per annum being 1,291,898 cwts. In the seven years 1899–1895 the quantity was 8,075,311 cwts., the average per annum being 1,153,616 cwts.; in the seven years 1897–1903 the quantity was 9,855,097 cwts., the annual average being 1,407,871 cwts. The increase in the period thus amounted to about 22 per cent. The increase was entirely due to the trawled fish. In the years 1892–1897 the line-caught fish amounted to 5,186,069 cwts., and the annual average to 864,345 cwts.; in the next six years the total was 2,511,117 cwts. and the annual average 418,519 cwts., showing a decrease of 52 per cent. In the first period the quantity of trawl-caught fish was 2,281,429 cwts., the average per annum being 380,238 cwts.; in the second period the quantity was 5,981,168 cwts. and the annual average 996,861 cwts., showing an increase of about 162 per cent.

The total quantity of cod landed in the twenty years 1889–1908 amounted to 8,384,656 cwts., or an average per annum of 419,233 cwts. In the first ten years the quantity was 3,381,396 cwts., the annual average being 338,140 cwts.; in the second ten years the quantity totalled 5,003,260 cwts., the average per annum being 500,326 cwts. The increase, comparing one period with the other, thus amounted to about 48 per cent. Except during the three years 1906–1908, all the cod are returned as having been taken either by line or by trawl; in the three years referred to small quantities are included under "nets," that is, gill-nets. In the years 1892-1899 the quantity taken by line was 2,057,712 cwts., the annual average being 257,214 cwts.; in the period 1901-1908 the quantity aggregated 1,211,557 cwts., with an average per annum of 151,445 cwts. There was thus an aggregate decrease in the latter period of 846,155 cwts. of the cod taken by line, or about 41 per cent. The quantity of cod taken by trawl in the period 1892–1899 was 830,514 cwts., the average per annum being 103,814 cwts.; in the period 1901–1908 the quantity was 3,021,285 cwts., with an annual average of 377,661 cwts. There was thus an increase of the trawled cod amounting for the period to 2,190,771 cwts., or about 264 per cent. The increase in the quantity caught by trawl has thus been considerably greater than the decrease in the quantity taken by line.

The aggregate quantity of ling taken in the twenty years amounted to 1,517,779 cwts., an annual average of 75,889 cwts. In the first ten years, 1889-1898, the aggregate quantity was 461,294 cwts., the annual average being 46,129 cwts.; in the ten years 1899–1908 the quantity was 1,056,485 cwts., the average per annum being 105,648 cwts. There was thus an increase, comparing one period with another, of 595,191 cwts., or about 129 per cent. The quantity taken by line in the eight years 1892–1899 amounted to 353,175 cwts., the average per annum being 44,147 cwts.; in the eight years 1901–1908 the quantity was 437,777 cwts. and the average 54,722 cwts. There was thus in the case of ling an actual increase in the quantity taken by line to the amount of about 24 per cent. In 1908 the quantity was, indeed, more than double what it was in 1892, and it was greater than the quantity taken by trawl in the same year. The quantity of trawl-caught ling in the period 1892–1899 amounted to 64,470 cwts., the average per annum being 8059 cwts.; in the eight years 1901–1908 the quantity was 461,730 cwts., and the average 57,716 cwts. The increase thus amounted to about 616 per cent. Further, in the period 1901–1908 the proportion of line-caught ling to the total was almost 49 per cent., whereas with the cod it was only 28 per cent.—about 51 per cent. in the one case and about 72 per cent. in the other being taken by trawl.

Another fish of the deep water is the torsk or tusk, and the quantity landed in the twenty years aggregated 95,211 cwts., the annual average being 4761 cwts. In the first ten years the total was 19,811 cwts. and the average 1981 cwts.; in the second ten years the quantity was 75,400 cwts. and the average per annum 7540 cwts., an increase of almost 281 per cent. All the fish are entered as taken by line until 1903; from 1903 till 1908 the total taken by trawl amounted to 10,217 cwts., with an average per annum of 1703 cwts.; in the same years the quantity taken by line amounted to 43,199 cwts., with an average of 7200 cwts. The proportion of tusk taken by line in these six years was thus about 81 per cent., 19 per cent. being taken by trawl.

The aggregate quantity of the saithe or coalfish landed in the twenty years amounted to 1,013,576 cwts., the annual average for the period being 50,679 cwts. In the ten years 1889–1898 the quantity totalled 356,090 cwts., the average being 35,609 cwts.; in the ten years 1899–1908 the quantity was 657,486 cwts. and the annual average 65,749 cwts. The aggregate increase in the latter period was thus 301,396 cwts., or about 85 per cent. The quantity taken by line in the years 1892–1899 amounted to 256,639 cwts., with an average of 32,080 cwts.; in the years 1901–1908 the quantity was only 93,201 cwts. and the average per annum 11,650 cwts., a decrease of about 64 per cent. The trawl-caught saithe totalled 30,397 cwts. in the period 1892–1899, with an annual average of 3800 cwts.; whereas in the years 1901–1908 the aggregate was 484,897 cwts. and the average per annum 60,612 cwts., or an increase of nearly 1500 per cent.

In the twenty years the aggregate quantity of haddocks landed on the East Coast amounted to 16,685,128 cwts., the average per annum being 834,256 cwts. In the ten years, 1889–1898, the quantity was 7,479,307 cwts., the average per annum being 747,931 cwts.; in the next ten years the quantity was 9,205,821 cwts., the average being 920,582 cwts., and the increase in the period 1,726,514 cwts., or 23 per cent. The quantity taken by line in the eight years, 1892–1899, was 3,401,195 cwts., the average being 425,149 cwts.; in the years 1901–1908 the quantity was 991,442 cwts., and the average per annum 123,930 cwts., showing a decrease of 71 per cent. The trawl-caught haddocks in the first period totalled 2,738,326 cwts., the average being 342,291 cwts.; in the second period the quantity was 6,750,723 cwts., and the average 843,840 cwts., showing an increase of 147 per cent. In the first period the proportion of line-caught haddocks was about 55 per cent. and trawl-caught 45 per cent. of the total. In the second period the proportion of the former was under 14 per cent. and of the latter over 76 per cent., which shows how much the trawled haddocks have replaced those taken by line.

The total quantity of whiting taken in the twenty years amounted to 1,652,759 cwts., the average per annum being 82,638 cwts. In the first ten years of that period the aggregate was 426,462 cwts., the average being 42,646 cwts.; in the last ten years the total amounted to 1,226,297 cwts., and the annual average was 122,630 cwts., showing an increase of about 188 per cent. In the years 1892–1899 the quantity taken by line was 195,142 cwts., with an average of 24,393 cwts.; in the years 1901–1908 the quantity was 142,069 cwts., the average being 17,759 cwts., showing a decrease of about 27 per cent. The trawled whitings in the first period totalled 84,824 cwts., the average per annum being 10,603 cwts.; in the second period the total was 970,922 cwts. and the average 121,365 cwts., showing an increase of 1045 per cent. In the first period the line-caught whiting formed about 70 per cent. of the total, and in the second period about 13 per cent. only.

The only other fish classified among the round fishes throughout the tables is the conger eel, of which in the twenty years 60,886 cwts. were landed, the average per annum being 3044 cwts. In the first ten years the quantity was 29,756 cwts., and the average 2976 cwts.; in the second period the quantity was 31,130 cwts., the average being 3113 cwts., showing an increase of about 5 per cent. The quantity taken by line in the years 1892–1899 was 24,722 cwts., and the average 3090 cwts.; in the second period the quantity was 20,589 cwts. and the average 2574 cwts., a decrease of about 17 per cent. In the first period the quantity of trawled conger was 667 cwts., with an average of 83 cwts.; in the second period the quantity was 2835 cwts., the average being 354 cwts., an increase of 325 per cent. The proportion of conger taken by line in the years 1901–1908 was about 88 per cent., 12 per cent. being caught by trawl.

Among other round fishes included in the tables are gurnard, catfish, angler or monk, and hake, but the statistics referring to them go back only to 1904 (*see* p. 157). So far as the five years show, gurnards have rather diminished in quantity, hake have considerably diminished, while catfish have remained steady, and anglers much increased.

Among the important group of the flat-fishes, it is not possible to give details as to the total flat-fishes over the period, for reasons stated below.

The quantity of turbot landed in the twenty years was 103,593 cwts., the average per annum being 5180 cwts. In the first ten years the quantity was 43,011 cwts., and in the last 60,582 cwts., the respective averages being 4301 cwts. and 6058 cwts. per annum. There was thus an increase of about 41 per cent. The quantity taken by line in the first period, 1892–1899, was 1102 cwts., the average being 138 cwts. per annum; in the years 1901–1908 the quantity was only 196 cwts. and the average 24 cwts., a decrease of about 82 per cent. The quantity of trawled turbot landed in the two periods was 33,226 cwts. and 49,228 cwts., the averages being 4153 cwts. and 6153 cwts., the increase amounting to about 48 per cent. Thus about 99 per cent. of the turbot were landed by trawlers.

The aggregate quantity of halibut landed in the twenty years was 485,125 cwts., showing an annual average of 24,256 cwts. The increase in the ten years, 1899–1908, over the previous ten years amounted to 145,261 cwts., or about 85 per cent. The quantity taken by line in the years 1892-1899 was 153,064 cwts., the average being 19,133 cwts.; in the period 1901-1908 the quantity was 198,657 cwts. and the average per annum 24,832 cwts., an increase of 45,593 cwts., or nearly 30 per cent. The quantities taken by trawl in the two periods were 8539 cwts., with an average of 1067 cwts., and 77,417 cwts., with an average of 9677 cwts., an increase of about 807 per cent. The figures show that in the period 1901–1908 about 72 per cent. of the halibut landed were caught by line.

The quantity of lemon soles landed in the twenty years aggregated 448,317 cwts., or an average of 22,416 cwts. per annum. In the first ten years the quantity was 173,481 cwts., and the average 17,348 cwts.; in the second period the quantity was 274,836 cwts., the average per annum being 27,484 cwts., an increase of about 58 per cent. The quantity taken by line in the years 1892–1899 was only 703 cwts., the average being 88 cwts.; in the second period the quantity was 1109 cwts., and the average 139 cwts. There was thus an increase of about 58 per cent. The trawled lemon soles in the first period amounted to 148,695 cwts., with an average of 18,587 cwts.; in the second period the quantity was 229,905 cwts. and the average 28,738 cwts., showing an increase of 55 per cent. About 99 per cent. of the total in the last period were taken by trawl.

The other flat-fishes included in the tables are "flounders, plaice, and brill," which were not separately distinguished until 1904, and comparison cannot be made as to the quantities of any of these fishes before the year named. In the five years, 1904–1908, the quantity of plaice landed diminished considerably and almost steadily from 62,565 cwts. in 1904 to 44,596 cwts. in 1908. The quantity of brill also decreased from 1408 cwts. to 701 cwts. Dabs increased from 6290 cwts. to 10,274 cwts. Witches decreased from 23,891 cwts. to 19,679 cwts., and megrims increased from 10,331 cwts. to 12,311 cwts.

The quantity of skates and rays, of which several species are tabulated together, landed in the period 1889–1908 amounted to 1,064,302 cwts., the average per annum being 53,215 cwts. In the first ten years the quantity was 379,146 cwts. and the average 37,915 cwts.; in the second ten years the quantity was 685,156 cwts. and the average 68,516 cwts., showing an increase of about 81 per cent. In the eight years, 1892–1899, the quantity taken by line was 273,035 cwts., the average being 34,129 cwts.; in the years 1901-1908 the total amounted to 294,505 cwts., and the average was 36,813 cwts. There was thus an increase in the line-caught fish to the extent of about 8 per cent. The quantity taken by trawl in the first of the two periods was 63,427 cwts., the average being 7928 cwts.; in the second period the quantity was 283,602 cwts. and the average 35,450 cwts., showing an increase of 347 per cent. While the proportion of the skates and rays in the first period which were taken by trawl amounted to barely 19 per cent., in the second period it was about 49 per cent.

Orkney and Shetland.

Pelagic Fish.—The fish of this group consist almost entirely of the herring, no sprats being included in the returns, and very few mackerel. The aggregate quantity of herrings landed in the twenty years, 1889–1908, amounted to 21,009,969 cwts., the average per annum being 1,050,498 cwts. In the first ten years the quantity was 4,872,313 cwts. and the average 487,231 cwts.; in the last ten years the quantity was 16,137,656 cwts. and the average 1,613,766 cwts. There was thus the very large increase of 11,265,343 cwts., or about 231 per cent. The increase in the quantity was fairly steady throughout the period; the highest amounts landed were in 1905—2,409,862 cwts.—and 1904—2,045,613 cwts.—and the lowest in 1892, when the total amounted to 163,075 cwts., and 1889, when it was 189,591 cwts. The quantities arranged in quinquennial periods are as follows:—

Years.	Cwts.	Years.	Cwts.
1889–1893......	276,935	1899–1903......	1,234,321
1894–1898......	697,528	1904–1908......	1,993,210

The total quantity of mackerel taken in the twenty years was 2924 cwts., with an average per annum of 146 cwts. The progress of this fishery is indicated by the figures of quantities in the quinquennial periods, viz., 40, 97, 186, and 261 cwts.

Round Fishes.—The quantity of cod taken in the twenty years amounted 1,692,770 cwts., with an average per annum of 84,638 cwts. In the first years the aggregate was 1,084,192 cwts., the average being 108,419 cwts.; in the second ten years the quantity was 608,578 cwts. and the average 60,858 cwts. There was thus a decrease of about 44 per cent., and it was entirely in connection with line fishing. The quantity taken by line in the years 1892–1899 was 719,777 cwts., the average per annum being 89,972 cwts., whereas in the years 1901–1908 the quantity was 341,839 cwts., the average being 42,730 cwts., and the decrease about 53 per cent. The quantity taken by trawl in the first period was 21,045 cwts., the average being 2631 cwts.; in the second period the quantity was 160,705 cwts. and the average 20,088 cwts. The increase of the trawled cod landed thus amounted to about 663 per cent. About 68 per cent. of the total cod landed in the years 1901-1908 was, however, caught by line.

The quantity of ling landed in the twenty years was 541,702 cwts., the average per annum being 27,085 cwts. In the period 1889-1898 the quantity was 424,566 cwts., the average being 42,457 cwts.; in the second period, 1899–1908, the total was 117,136 cwts., the annual average being 11,714 cwts. There was thus a decrease of 307,430 cwts. in the second period, or about 72 per cent. With the exception of 1541 cwts. landed by trawlers between 1900 and 1908, all the ling were taken by line.

The aggregate of the tusk landed in the twenty years was 90,976 cwts., the average being 4549 cwts. In the first ten years the quantity was 59,706 cwts. and the average 5971 cwts.; in the last ten years the quantity was 31,270 cwts. and the average 3127 cwts., showing a decrease of about 48 per cent. All the tusk were caught by line, except 15 cwts. in 1906 and 1908.

The total of the saithe in the twenty years was 474,830 cwts., with an average of 23,741 cwts. Contrasting the first ten years and the last ten, there was a decrease in the latter period of 173,536 cwts., or over 53 per cent. The great bulk of the saithe was taken by line, but in 1900 and 1901, and 1905–1908, some hundreds of cwts. were landed by trawlers. The decrease in the line-caught saithe, contrasting the two periods 1892–1899 and 1901–1808, amounted to 150,000 cwts., or nearly 60 per cent.

The proportion taken by trawl was, however, small, amounting to about 2 per cent. in the latter of the two periods.

The decrease in the haddocks has been much less marked. Over the whole twenty years the aggregate quantity landed was 580,687 cwts., the average per annum being 29,034 cwts. In the ten years, 1889–1898, the total was 316,559 cwts. and the average 31,656 cwts.; in the last ten years the quantity was 264,128 cwts., the average being 26,413 cwts., showing a decrease of about 16·5 per cent. Very few trawled haddocks were landed throughout the period, the total amounting to about 1200 cwts. Contrasting the eight years, 1892–1899 and 1901–1908, the decrease of the line-caught haddocks amounted to 52,090 cwts., or about 20 per cent.

The whitings landed were comparatively trifling, totalling for the twenty years 6373 cwts., with an average per annum of 319 cwts. They were all taken by line, with the exception of 2 cwts., and comparison of the periods shows that, contrary to the usual rule, the quantity has increased. The increase in the last ten years amounted to 4995 cwts., or 725 per cent.; the largest quantity landed in any one year was in 1908, viz., 1354 cwts.

Contrasting with the whiting is the diminution in the quantity of conger eels landed. The aggregate amounted to 904 cwts., the annual average being 45 cwts. In the first period the quantity was 826 cwts.; in the last it was only 78 cwts., and none at all were landed in 1907 and 1908.

Among the flat-fishes, the quantity of turbot landed in the twenty years was only 162 cwts.; in some years none were taken. The decrease in the last ten years was about 60 per cent.

The quantity of halibut taken was much greater, aggregating 81,569 cwts., or an average of 4078 cwts. per annum. With the exception of 20 cwts., they were all caught by line, and a comparison of the two periods shows a decrease in the latter amounting to 51,187 cwts., or about 77 per cent.

The skates and rays also show a diminution. The aggregate quantity taken in the twenty years amounted to 52,942 cwts., the average per annum being 2647 cwts. Except for 15 cwts., they were all caught by line, and the decrease in the last period of ten years compared with the first amounted to almost 21,000 cwts., or 57 per cent.

West Coast.

Pelagic Fish.—As on the East Coast, the pelagic fishes landed consist almost entirely of herring. Over the whole of the twenty years the percentage of herrings works out at 99 per cent. and mackerel at 0·9 per cent.; but in the last ten years of the period the percentage of herrings was 98·2, while mackerel was 1·7 per cent., showing, as referred to below, an increase in the fishing for mackerel. The quantity of sprats returned as landed on the West Coast is quite insignificant.

The aggregate quantity of herrings landed in the twenty years amounted to 15,577,868 cwts., the average per annum being 778,893 cwts.; in the first ten years the quantity was 8,352,760 cwts., the average being 835,276 cwts., whereas in the last ten years of the period the quantity was 7,225,108 cwts. and the average per annum 722,511 cwts. There was thus a decrease of 1,127,652 cwts., or about 13·5 per cent., comparing the two periods of ten years. The highest figure in any one year was in 1891, when the total of the herrings landed amounted to 1,252,202 cwts.; the lowest year was 1906, when the total was 554,246 cwts.

The aggregate of the mackerel landed in the twenty years was 152,652 cwts., the average per annum being 7633 cwts. The quantity taken in the ten years, 1889–1898, was 23,378 cwts., the average per annum being

2338 cwts.; in the ten years, 1899–1908, the total was 129,274 cwts., the annual average being 12,927 cwts., showing therefore the great increase of 105,896 cwts., or about 453 per cent. It is really during the last five years of the period, viz., 1904–1908, that mackerel have been taken in anything like large quantities, and the highest figure was in 1907, when the quantity landed amounted to 29,810 cwts.

The total quantity of sprats returned for the twenty years was 785 cwts., and in most years none were taken.

Round Fish.—The total quantity of cod landed in the twenty years amounted to 874,058 cwts., the average per annum being 43,703 cwts. In the first ten years the quantity amounted to 523,597 cwts., the annual average being 52,360 cwts.; in the last ten years of the period the quantity was 350,461 cwts. and the average 35,046 cwts. The decrease thus amounted to 173,136 cwts., or 33 per cent. This decrease was due entirely to the decline in the line-caught fish. In the eight-years, 1892–1899, the quantity taken by line was 406,895 cwts., the average per annum being 50,862 cwts.; in the eight years, 1901–1908, the quantity was 229,213 cwts., the average per annum being 28,652 cwts., a decrease of nearly 44 per cent. The quantity of trawled cod was small. In the first eight years it totalled 981 cwts., the average being 123 cwts., and in the last eight years the quantity was 7784 cwts. and the average 973 cwts., an increase of 6803 cwts. and 693 per cent. The proportion of the trawled cod to those taken by line was, however, small, amounting in the latter period to only about 3 per cent. of the total, less, indeed, than the quantity taken by "net"—gill-nets being used largely in certain localities—the percentage of which was 9, while the proportion taken by line amounted to about 88 per cent.

The aggregate of ling was greater than that of cod, amounting in the twenty years to 941,205 cwts., or an average of 47,060 cwts. per annum. The decrease in the ten years, 1899–1908, when compared with the first ten years, was, however, greater, namely, nearly 62 per cent. In the former period the quantity was 680,059 cwts., the average being 68,006 cwts.; in the latter the quantity was 261,146 cwts. and the average 26,115 cwts.

Tusk, on the other hand, showed an increase. The total quantity landed in the twenty years was 29,374 cwts., giving an average per annum of 1469 cwts. In the first half of the period the quantity was 12,125 cwts., with an average of 1212 cwts.; in the second half the total was 17,249 cwts., the average being 1725 cwts., an increase of about 42 per cent. All the tusk were taken by line, except 148 cwts. in 1907, which were caught by trawl.

The quantity of saithe taken in the twenty years amounted to 558,085 cwts., the average being 27,904 cwts. per annum. In the first period the quantity was 314,158 cwts. and the average 31,416 cwts.; in the second period the quantity was 243,927 cwts. and the average 24,393 cwts. There was thus a decrease of 70,231 cwts., or about 22 per cent. A comparatively small amount of the saithe are returned as taken by trawl, and only in certain years. But considerable quantities appear in recent years to have been caught by gill-nets, the amount so taken in 1908 having been 7865 cwts., or nearly 26 per cent. of the whole.

On the West Coast haddocks have not the importance they have on the East. The quantity taken in the twenty years amounted to 493,942 cwts., with an average of 24,697 cwts.—thus less than ling, cod, or saithe. The aggregate for the first period of ten years was 302,677 cwts., with an annual average of 30,268 cwts.; for the second period the total amounted to 191,265 cwts., the average per annum being 19,126 cwts. In the latter period of ten years there was therefore a decrease of 111,412 cwts., or about 37 per cent. The quantity taken by line in the eight years, 1892–

1899, amounted to 213,085 cwts., with an average of 26,636 cwts., while in the period 1901–1908 the amount was 146,490 cwts., the average being 18,311 cwts., and the decrease about 31 per cent. With one or two exceptions, the quantity of haddocks landed by trawlers in any one year was small. In the eight years, 1892–1899, it amounted to 1571 cwts., the average being 196 cwts.; in the later eight years the quantity was 20,947 cwts. and the average 2618 cwts. The increase was thus 19,376 cwts., or about 1233 per cent. The proportion in the latter period was—line 87·4 per cent., trawl 12·5 per cent., but in the years 1907 and 1908 this proportion was very much higher.

The aggregate of whiting landed on the West Coast in the twenty years was 152,183 cwts., an average of 7609 cwts. In the first ten years the quantity was 75,838 cwts., the average being 7584 cwts.; in the last ten years the amount was 76,345 cwts. and the average 7634 cwts. There was thus a slight increase in the quantity of whiting, something under 1 per cent. Almost all were taken by lines, but the greater quantity taken by trawl in the second period compared with the first period was more than sufficient to account for the increase mentioned in the total.

The quantity of conger eel landed in the twenty years was 243,353 cwts., an average of 12,168 cwts. per annum. The quantity in the first ten years amounted to 113,097 cwts.. the average being 11,310 cwts.; in the second period the quantity was 130,256 cwts. and the average 13,026 cwts. There was thus, as with tusk and whiting, an increase, which amounted to 17,159 cwts., or about 15 per cent. With the exception of 722 cwts. landed by trawlers throughout the twenty years—and chiefly in the last four—all the conger were taken by line, except 96 cwts. by "net" in 1906–1907.

Among the other round fishes included in the tables are gurnards, catfish, anglers, and hake, but the quantities, as will be seen from the detailed tables, are small, and refer only to the last few years.

Among the *flat fishes* the aggregate of turbot landed was 9617 cwts., or an average of 481 cwts. The decrease in the last ten years, compared with the first, amounted to about 35 per cent. The average in the first period was 581 cwts. per annum and in the second 381 cwts.

The total for halibut was 48,002 cwts., or an average of 2400 cwts. Here also there was a decrease of about 34 per cent in the latter ten years of the period. In the first ten years the annual average was 2894 cwts., and in the last ten years 1906 cwts. As with the turbot, the quantity landed by trawlers was comparatively small and irregular.

The aggregate quantity of lemon soles was small, namely 3440 cwts., or an annual average of only 172 cwts. In the last ten years, 1899–1908, there was a decrease of 73 per cent. The decrease in the line-caught fish was 50 per cent., and in those taken by trawl 5 per cent. The percentage proportions in the last ten years were—line, 68·6 per cent.; trawl, 29·1 per cent.; net, 2·3 per cent.

As on the East Coast, the other species of flat fishes were only separately distinguished in 1904 and since.

The total quantity of skates and rays amounted to 348,831 cwts., the annual average being 17,442 cwts. In the first ten years the quantity was 156,792 cwts., the average being 15,679 cwts.; in the second period the quantity was 192,030 cwts. and the average 19,204 cwts., showing an increase of about 22·5 per cent. Most of the increase was due to the larger landings by trawlers in the second period, but the proportion landed by trawl over the last eight years amounted to only 2·3 per cent.

THE VALUES OF THE FISH LANDED.

Appended to this report will be found tables showing the values of the fish of the different kinds landed in the years 1889–1908, and also the values of those taken by the chief methods of fishing.

Beginning as before with the figures for the whole of Scotland, it is found that the aggregate value of the fish landed in the years 1888–1908 amounted to £42,993,646, or an average per annum for the twenty-one years of £2,047,316. For the year 1888 only the total for the whole of Scotland is given, but, taking the period 1889–1908, it is possible to differentiate the values of the fish pertaining to the different coasts. The aggregate value of the fish landed on the East Coast in the period 1899–1908 amounted to £17,720,785, the average per annum being £1,772,078. In the years 1889-1898 the total was £12,212,851, and the average £1,221,285. There was thus an increase in the last ten years of £5,507,934, or about 45 per cent.

In the period 1889–1898 the aggregate value of the fish landed in the Orkney and Shetland Isles was £1,408,347, the average per annum being £140,835. In the years 1899–1908 the aggregate was £4,528,444 and the average £452,844, showing an increase of £3,120,097 or about 221 per cent.

The aggregate value of the fish landed on the West Coast in the first period was £2,848,503, the annual average being £284,850. In the second period the value amounted to £2,941,956 and the average was £294,196. The increase on the West Coast was thus small, amounting to about 3 per cent, when the two periods are compared.

Turning now to the proportions represented by the different methods of fishing, the aggregate value of the fish taken by line in the sixteen years, 1892–1899 and 1901–1908, was for the whole coast £6,990,107, giving an annual average of £436,882. In the first period, 1892-1899, the aggregate was £4,251,250, the average being £531,406 per annum. In the second period, 1901–1908, the aggregate was £2,738,857 and the average £342,357. There was therefore a decrease amounting on the whole to £1,512,393, or about 35 per cent.

On the other hand, the increase in the value of trawled fish was very great. In the period 1892–1899 the aggregate was £2,791,393, the annual average being £348,924. In the second period, 1901–1908, the aggregate value of the trawled fish landed amounted to £7,183,748, the average per annum being £897,968. The increase thus amounted to £4,392,355, or about 157 per cent.

The aggregate value of the net-caught fish, comprising for the most part herring, was, in the first period, £6,776,976, giving an average of £847,122. In the second period the value amounted to £10,752,653, the average being £1,344,082. The increase in this class between the two periods was therefore £3,975,677, or about 59 per cent.

On the East Coast the decrease in the value of the fish caught by line, comparing the two periods, 1892–1899 and 1901–1908, amounted to 38 per cent. On the other hand, the increase in the value of fish taken by trawl amounted to 157 per cent. There was also a large increase, amounting to 27 per cent., in the fish taken by "net," that is, chiefly herrings.

In Orkney and Shetland the decrease in the value of the line-caught fish in the same periods was about 29 per cent.; the increase in the trawled fish —not of great importance—amounted to 688 per cent.; while the increase in the "net" fish was 222 per cent., and represented the increase in the value of the herrings.

On the West Coast in the same periods the decrease in the value of the line-caught fish amounted to 25 per cent., the increase of the trawled fish to 70 per cent., and the increase of the value of the "net"-caught fish to 15 per cent.

It is not necessary to go into the details as to the values of the various fishes landed, the information regarding which will be found in the appended tables, but the following summary may be given showing the average value per annum in each of the two periods for the different coasts in the case of the more important fishes. The following shows the average value for the pelagic fishes, herring, sprat, mackerel, and with these are included the other "net"-caught fish, the smelt or sparling:—

	EAST COAST.		ORKNEY AND SHETLAND.	
	1889–1898.	1899–1908.	1889–1898.	1899–1908.
	£	£	£	£
Herring	516,141	666,129	89,435	413,264
Sprat	1,718	3,857	..	..
Mackerel	263	1,542	10	45
Sparling	978	747	..	..
Total	519,101	672,276	89,445	413,310

	WEST COAST.		ALL SCOTLAND.	
	1889–1898.	1899–1908.	1889–1898.	1899–1908.
	£	£	£	£
Herring	199,767	223,664	765,143	1,303,057
Sprat	1	6	1,757	3,863
Mackerel	1,328	4,083	1,403	5,670
Sparling	141	201	1,084	949
Total	201,237	227,954	769,387	1,313,540

From the above table it will be found that the value of the herrings landed has considerably increased—for all Scotland to the extent of 70 per cent., for the East Coast to the extent of 29 per cent., for the West Coast to the extent of 12 per cent., and for Orkney and Shetland by no less than 362 per cent. Although the proportion of mackerel, and therefore its relative importance at present, is much less, the percentage increase of the value has been greater than with the herring, namely, 304 per cent. for all coasts, 486 for the East Coast, 350 for Orkney and Shetland, and over 207 for the West Coast. The increase in the value of sprats was about 120 per cent. for all coasts.

In a similar way the particulars regarding the values of the other fishes may be set forth, and in the following table are given the average values of the different fishes landed in the various periods for each coast and for all Scotland, the values of those fish taken by line and by trawl being distinguished from one another:—

East Coast.

	Line.		Trawl.		Total.	
	1892-1899	1901-1908	1892-1899	1901-1908	1889-1898	1899-1908
	£	£	£	£	£	£
Cod	106,895	74,152	40,169	164,505	135,214	228,501
Ling	15,885	18,135	2,808	15,862	17,473	32,701
Saithe	4,201	2,311	586	11,079	4,784	11,917
Haddock ...	215,609	78,833	178,374	416,688	370,761	490,867
Whiting ...	11,393	8,940	4,871	38,094	17,575	42,849
Conger Eel ...	1,957	1,382	43	159	1,883	1,689
Turbot	331	66	13,424	21,691	14,534	21,020
Halibut	26,819	43,425	1,515	16,724	23,317	54,913
Lemon Soles ...	155	221	35,600	57,168	31,597	54,837
Skates and Rays	10,260	11,227	1,705	8,369	10,513	18,960

Orkney and Shetland.

	Line.		Trawl.		Total.	
	1892-1899	1901-1908	1892-1899	1901-1908	1889-1898	1899-1908
	£	£	£	£	£	£
Cod	20,795	15,397	920	7,245	25,150	21,155
Ling	...	...	...	...	9,692	3,344
Tusk	...	...	...	...	854	505
Saithe	...	...	...	...	2,638	1,506
Haddock ...	...	...	...	...	8,472	10,946
Whiting ...	...	...	...	...	16	190
Conger Eel ...	...	...	...	...	31	3
Turbot	...	...	...	...	9	9
Halibut ...	...	...	...	...	3,409	1,182
Skates and Rays	...	...	...	...	523	260

West Coast.

	Line.		Trawl.		Total.	
	1892-1899	1901-1908	1892-1899	1901-1908	1889-1898	1899-1908
	£	£	£	£	£	£
Cod	17,293	12,884	68	368	17,858	14,627
Ling	...	...	...	...	20,225	9,268
Tusk	...	...	...	...	253	419
Saithe	...	...	...	...	4,480	4,296
Haddock ...	12,285	9,728	150	966	13,116	10,001
Whiting ...	...	...	...	...	5,207	5,741
Conger Eel ...	...	...	...	...	5,638	5,854
Turbot	...	...	...	...	686	489
Halibut ...	...	...	...	...	1,698	1,775
Lemon Soles ...	...	...	...	...	432	174
Skates and Rays	3,030	4,398	19	138	2,611	4,462

ALL COASTS.

	Line.		Trawl.		Total.	
	1892-1899	1901-1908	1892-1899	1901-1908	1889-1898	1899-1908
	£	£	£	£	£	£
Cod	144,984	102,433	41,157	172,118	177,139	264,282
Ling	42,970	28,408	2,813	15,995	48,774	45,314
Tusk	...	...	...	...	1,643	2,873
Saithe	10,822	7,334	599	11,305	12,645	17,779
Haddock ...	237,033	99,460	178,540	417,671	382,931	511,814
Whiting ...	16,964	14,481	4,887	38,171	23,241	48,781
Conger Eel ...	7,607	7,267	91	179	7,105	7,546
Turbot	971	354	13,447	21,775	15,170	21,519
Halibut... ...	31,382	46,281	1,516	16,801	27,090	57,870
Lemon Soles ...	324	360	35,642	57,207	29,986	55,013
Skates and Rays	13,673	15,860	1,725	8,507	12,819	23,682

It will be found that, taking all the coasts together, decreases occurred in the average values of all the fishes taken by line, with the exception of halibut, lemon soles, skates and rays. The decrease in the value of line-caught haddock amounted to 58 per cent., of line-caught cod to 29 per cent., of turbot to 64 per cent., of ling to 34 per cent., of saithe to 32 per cent., and of whiting to nearly 15 per cent. On the other hand, the increase in the value of line-caught halibut amounted to over 47 per cent., while the increase in skates and rays was 16 per cent., and in lemon soles 11 per cent.

There were great increases in the value of the trawl-caught fishes, amounting, for all coasts together, to 1787 per cent. for saithe, 1008 per cent. for halibut, 318 per cent. for cod, 468 per cent. for ling, 681 per cent. for whiting, 134 per cent. for haddock, 60 per cent. for lemon soles, 54 per cent. for turbot, and 393 per cent. for skates and rays. Since the increase in the values of the trawled fish more than counterbalanced the decrease in the value of the fish taken by line, with the single exception of ling—where there was a decrease altogether of 7 per cent.—the increase in the total value was noteworthy. It varied from 114 per cent. for halibut, 110 per cent. for whiting, and 85 per cent. for skates and rays, to 41 per cent. for saithe, 42 per cent. for turbot, and 34 per cent. for haddock.

On the East Coast the average values of the line-caught fish showed diminution in all cases except for ling, halibut, lemon soles, skates and rays. The decrease in the value of cod amounted to 31 per cent., of saithe to 45 per cent., haddocks 63 per cent., whiting 21 per cent., turbot 80 per cent. The increased value of ling was 14 per cent., of halibut 62 per cent., of lemon soles 43 per cent., of skates and rays 9 per cent.

The values of the trawled fish showed increases in all items, ranging from 1790 per cent. for saithe, 1004 per cent. for halibut, 309 for cod, to 134 for haddocks, and 62 for turbot. And there were increased percentages in the value of all the fishes landed, trawled and line-caught combined.

The particulars for the West Coast do not allow the same detailed comparison to be made, since the entries of trawled fish are only for certain years, but for the totals, however caught, the following showed increases:—Whiting 10 per cent., tusk 66 per cent., conger eel 4 per cent., halibut 4·5 per cent., skates and rays 71 per cent. And decreases occurred in the average values of the following fishes:—Cod 18 per cent., ling 54 per cent., saithe 4 per cent., haddocks 24 per cent., turbot 29 per cent., lemon soles 60 per cent.

In cases where comparison can be made, it appears that the value of the trawled fish landed on the West Coast increased, but it is evident that such increase was not sufficient to counterbalance the loss from the line-caught fish, as was the case on the East Coast.

In Orkney and Shetland the fishes showing increased values in the periods were :—Ling by 65 per cent., haddocks 29 per cent., whiting 1087 per cent. On the other hand, the following fishes showed decreases in average value :—Cod by 16 per cent., tusk 41 per cent., saithe 43 per cent., conger eel 90 per cent., halibut 65 per cent., skates and rays 50 per cent. As on the West Coast, the decreases were in the line fishing, and they were not made up by the increase in the value of trawled fish landed, as on the East Coast.

SHELL-FISH.

Tables have also been prepared and will be found appended dealing with the statistics of the shell-fish landed in Scotland from the year 1883 onwards to 1908. Below each of the shell-fish which is distinguished in the statistics is separately dealt with in regard to quantity and in regard to value. Since the quantities are expressed in different terms, sometimes in terms of weight, as for mussels and clams, and sometimes in terms of number, as for oysters, lobsters, and crabs, a statement cannot be given dealing with the quantities as a whole. The value, however, of all the shell-fish may be examined. The aggregate value of the shell-fish for the twenty-six years amounted to £1,957,881, or an average per annum of £75,303. In the first period, 1883–1895, the value amounted to £965,549, giving an average of £74,273 ; in the second period, 1896–1908, the total was £992,332, the average being £76,333 There was thus an increase of about 2·8 per cent.

On the East Coast, the value for the whole period was £857,480, the average being £32,980. In the first period the total was £473,445, and the average £36,419 ; in the second period the total was £384,035, the average being £29,541. There was thus a decrease on the East Coast of nearly 19 per cent.

In Orkney and Shetland the aggregate value was £186,006, the average being £7154. In the first period the average was £6327, and in the second period it was £7,981, showing an increase of about 26 per cent.

On the West Coast there was also an increase in the value of the shell-fish landed. The aggregate for the whole period was £914,395, the annual average being £35,169. In the first period, 1883–1895, the total value amounted to £409,848, the average being £31,527, whereas in the period 1896–1908 the total value was £504,547 and the annual average £38,811, showing an increase of about 23 per cent.

Among the tables appended to this paper will be found some in which a comparison is made between the total value of the shell-fish of a particular coast and the value of the different kinds of shell-fish landed, and showing also the percentage of the total value of the shell-fish of that coast to the total value of the shell-fish of the whole of Scotland, and to the total value of all the fish landed on the same coast. With regard to the former point —the relative value of the different kinds of shell-fish from year to year in relation to the total value—the rise in lobsters, and especially in crabs, concurrently with the diminution in mussels, is noteworthy. The gradual rise in the relative value of lobsters and the decrease in the unclassified shell-fish are prominent features in the figures referring to Orkney and Shetland, while on the West Coast there has been a gradual increase in the unclassified shell-fish and a decrease in the values of the lobsters and crabs. The tables also show that the relative value of the shell-fish fisheries compared with the other fisheries, namely, for what are termed wet fish, has greatly diminished, except on the West Coast, where the decrease has been much less. Other tables are given showing the yield of the shell-fish fisheries of England and Wales for the years 1886–1907, together with the values, and instituting similar comparisons to those described above.

Oysters.

The oyster fishery in Scotland is a very small one in comparison with the oyster fishery in other countries, and it is less now than it used to be, owing to many natural beds having been depleted. In the twenty-six years, 1883–1908, the aggregate number of oysters landed was 10,529,000. The average number per annum over the period was 404,965. Comparing the first half of the period, 1883–1895, with the latter half, 1896-1908, the quantity landed in the former was 4,219,983, the average being 324,614 per annum, while in the second period the number was 6,309,104, and the average 485,316 per annum. There was thus a gross increase in the thirteen years of 2,089,120, or 49·5 per cent. This increase was entirely confined to the West Coast, and is owing to the cultivation of the mollusc in certain places, in particular Loch Ryan.

The number landed on the East Coast in the twenty-six years was 1,048,637, the average per annum being 40,332. In the first half of the period the number was 873,600, with an annual average of 67,200; in the second half the number was 175,037, the average being 13,464, showing therefore a decrease of about 80 per cent. This may be taken as indicating the depletion of the natural beds, in particular in the Firth of Forth, which at one time were very productive.

In Orkney and Shetland the gross number landed was 54,950, the annual average being 2113. In the years 1883–1895 the number was 48,750, and the average 3750 per annum; in the years 1896–1908 the number was 6200, the annual average being only 477 oysters, showing a decrease of about 87 per cent.

On the West Coast the number of oysters landed in the twenty-six years was 9,425,500, giving an average per annum of 362,519. In the first half of the period the number was 3,297,633, and the average 253,664; in the second half the number amounted to 6,127,867, the average being 471.374 oysters per annum. There was thus an increase in the thirteen years of about 86 per cent. The proportion for the different coasts in the two periods was as follows:—

	1883–1895.	1896–1908.
East Coast	20·7 per cent.	2·7 per cent.
Orkney and Shetland	1·1 ,,	0·1 ,,
West Coast	78·1 ,,	97·1 ,,

The figures in the detailed tables show that on the East Coast, in the year 1883, 414,700 oysters were landed, and 95,000 in the following year, and these represent, as it were, the last productive yield of the beds in the Firth of Forth. After that there was a fairly steady decline until 1900, when only 2600 oysters were landed. From 1901 to 1905 the number rose again considerably, but in 1906 no oysters were landed on the East Coast. In 1908 the number rose again to 14,900. In Orkney and Shetland the highest number in any year was 8000 in 1890, but in eight years of the last thirteen no oysters were landed. On the West Coast by far the highest numbers refer to recent years—for the reason stated above—in 1907 the number being 1,013,480, and in 1908 924,261.

With regard to the value of the oysters landed, the aggregate for the twenty-six years for the whole of Scotland was £43,560, or an average per annum of £1,675·4. In the first half the total value was £19,299, the annual average being £1,484·5 ; in the second half the total was £24,261, and the average £1,866·2, showing an increase of about 26 per cent.

On the East Coast the aggregate value amounted to £6111, the average being £235 ; in the first period the total was £5,294 and the average £407·2 ; in the second period the total was £817 and the average £62·8, showing a decrease amounting to about 84 per cent.

In Orkney and Shetland the aggregate value was £254, with an average of £9·7. The average in the first period was £17·6 and in the second £1·9, showing a decrease of about 88 per cent.

The aggregate value on the West Coast amounted to £37,195, the average per annum being £1,430·6. In the first period the total was £13,776 and the average £1,059·7 ; in the second period the total was £23,419, the average value per annum being £1,801·5. Here there was an increase of about 70 per cent. in the value, as compared with an increase of 86 per cent. in the number of oysters landed.

The allocation of the value to the different coasts in the two periods may be shown thus :—

	1883–1895.	1896–1908.
East Coast	27·4 per cent.	3·4 per cent.
Orkney and Shetland	1·2 ,,	0·1 ,,
West Coast	71·4 ,,	96·5 ,,

Comparing the percentage increase in value with that in number, it is obvious that the relative value has diminished. This is also shown by computing the average values per 100 oysters, in shillings, in quinquennial periods, as follows :—

	East Coast.	Orkney and Shetland.	West Coast.	All Scotland.
1884–1888	12·0	9·7	7·6	8·6
1889–1893	11·6	8·6	9·0	9·2
1894–1898	10·6	8·4	8·1	8·2
1899–1903	10·2	6·7	8·0	8·8
1904–1908	7·7	8·0	7·2	7·3

The considerable decrease in recent years may be attributed in part to the "scares" in connection with cases where enteric fever was traced to polluted oysters and other shell-fish.

Mussels.

The aggregate quantity of mussels landed in the twenty-six years in Scotland was 4,929,375 cwts., the average per annum being 189,591 cwts. In the first thirteen years the total amounted to 3,027,747 cwts., the average being 232,904 cwts. In the second period the quantity was 1,901,628 cwts., giving an annual average of 146,279 cwts. There was thus a gross decrease of 1,126,119 cwts. in the latter period, or about 37 per cent.

This decrease was most marked on the East Coast. The aggregate quantity amounted to 3,300,828 cwts., the average being 126,954 cwts. In the first half of the period the quantity was 2,094,077 cwts., with an average of 161,083 cwts. ; in the second half the total amounted to 1,206,751 cwts., the average being 92,827 cwts., showing a decrease of over 42 per cent.

The total for Orkney and Shetland was 83,827 cwts., the annual average being 3224 cwts. In the first thirteen years the total was 50,520 cwts., with an average of 3886 cwts.; in the last thirteen years the total amounted to 33,307 cwts., the average being 2562 cwts. There was therefore a decrease of about 34 per cent.

There was also a decrease on the West Coast, but less in proportion. The aggregate quantity in the twenty-six years was 1,544,720 cwts., the average per annum being 59,412 cwts. The quantity in the first period amounted to 883,150 cwts., with an average of 67,935 cwts.; in the second period the quantity was 661,570 cwts., and the average 50,890 cwts., showing a decline of about 25 per cent.

The detailed tables show that on the East Coast down to 1893 the quantity of mussels landed was always over 120,000 cwts., and sometimes over 200,000 cwts., a year. Since 1899 the quantity has not in any year been much over 70,000 cwts., and sometimes but little over 60,000 cwts. The decrease in the quantity of mussels has relation to the decline in line-fishing, as the chief use of the mussel in Scotland is for bait.

The proportions landed on the various coasts in the two periods are indicated in the following figures:—

	1883–1895.	1896–1908.
East Coast	69·1 per cent.	63·4 per cent.
Orkney and Shetland	1·6 „	1·7 „
West Coast	29·1 „	34·7 „

With regard to values, the total value during the twenty-six years was £286,228, giving an average of £11,009 per annum. In the first thirteen years of the period the total amounted to £181,298, the average being £13,946; in the second period the total was £104,930, and the average £8071. There was thus a decrease in the latter period of £76,368, or about 42 per cent. The aggregate value on the East Coast was £203,903, the annual average being £7842, and the decrease in the second period amounted to £72,881, or about 53 per cent.

The aggregate value for Orkney and Shetland for the whole period was only £6008, with an average of £231, and the decrease in the second period amounted to £1516, or 40 per cent. On the West Coast the aggregate value was £76,317, the average per annum being £2935, and the decrease in the second period was £1971, or about 5 per cent.

The value of mussels, like the value of oysters, has fallen in the period covered by the statistics so far as the East Coast and Scotland as a whole are concerned, but on the West Coast their value has increased. This is brought out in the following table showing the value, in shillings per cwt., in quinquennial periods:—

	East Coast.	Orkney and Shetland.	West Coast.	All Scotland.
1884–1888	1·3	2·1	0·9	1·2
1889–1893	1·3	1·2	0·9	1·2
1894–1898	1·2	1·1	1·0	1·1
1899–1903	1·1	1·4	1·1	1·1
1904–1908	1·0	1·8	1·3	1·1

Clams.

This shell-fish (*Pecten*) is used chiefly for bait, and, to a small extent, as food. It is local in its distribution from the commercial point of view, by far the greater quantity entered in the statistics having been taken from the Firth of Forth; small quantities are also got in the Clyde area. The aggregate for the East Coast of Scotland in the twenty-six years amounted to 334,793 cwts., the annual average being 12,877 cwts. In the first thirteen years the total was 208,600 cwts., the average being 16,046 cwts.;

in the second period the total was 126,193 cwts., the average being 9707 cwts. There was thus a decrease of 82,407 cwts., or about 39 per cent. The total landed on the West Coast in the twenty-six years was only 1735 cwts.

The total value for Scotland in the period was £43,467, of which the value on the East Coast amounted to £43,250. In the first thirteen years the average value was £2062, and in the last thirteen years £1282, showing a decrease of about 38 per cent.

The price of clams has kept up very well. The values in shillings per cwt., in the quinquennial periods above stated, were, on the East Coast, respectively 2·8, 2·1, 2·6, 2·6, and 2·8.

The greatest quantities were landed between 1888 and 1897; the smallest in 1902 and 1908. Since then the quantity has rather increased.

Lobsters.

This crustacean constitutes the most valuable item among the shell-fish fisheries of Scotland, and it differs from those molluscs which have been referred to above—oysters, clams, and mussels—inasmuch as the quantity and value have steadily increased. The aggregate number of lobsters landed on the coasts of Scotland in the twenty-six years, 1883–1908, amounted to 18,769,150, giving an annual average number of 721,890. In the first half of the period, 1883-1895, the total number was 9,239,689, the annual average being 710,745; in the second period the number was 9,529,461, and the average per annum 733,036, showing an increase of 3·1 per cent.

The aggregate on the East Coast was 2,689,496, the average being 103,442 per annum for the whole period. In the years 1883-1895 the number was 1,409,222, and the average 108,402, while in the second period the number was 1,280,274, and the annual average 98,483 lobsters. There was thus a decrease on the East Coast in the second period to the extent of 9 per cent. in the numbers landed.

There was, on the other hand, a notable increase in the lobster fishery of the Orkney and Shetland group. The aggregate number taken in the twenty-six years was 2,835,949—greater, therefore, than on the whole of the East Coast—and the average number per annum was 109,075. In the first period the number was 1,175,150, and the average 90,396, whereas in the second period the number was 1,660,799, and the annual average 127,754. There thus occurred an increase to the extent of over 41 per cent. in the number of lobsters landed.

On the West Coast, where nearly three-fourths of the lobsters are taken, the aggregate for the whole period amounted to 13,243,705 lobsters, giving an annual average of 509,373. In the first period the number was 6,655,317, and the average per annum 511,947; in the second period the number was 6,588,388, and the average 506,799. There was thus a decrease of about 1 per cent. in the number of lobsters landed on the West Coast in the second period as compared with the first. The highest numbers, amounting in one year—1885—to 774,000, were taken in the earlier years, but the period from 1896 to 1902 was also characterised by large catches.

The proportions in which the lobsters were landed on the various coasts in the two periods are shown in the following table:—

	1883–1895.	1896–1908.
East Coast............	15·2 per cent.	14·3 per cent.
Orkney and Shetland ..	12·7 „	15·1 „
West Coast	72·0 „	70·6 „

One of the chief features is the development of the fishing for lobsters at the Orkney and Shetlands, and it is in reality at the Orkneys that the great development has taken place, the lobsters landed at the Shetlands being much smaller in amount.

With regard to the value, the aggregate for the whole period for all Scotland amounted to £831,603, giving an average per annum of £31,985. The total for the years 1883-1895 amounted to £385,726, or an annual average of £29,671. In the years 1896-1908 the total was £445,877, and the annual average £34,298. There was thus an increase in the value to the extent of 15·6 per cent.

On the East Coast there was, however, a small decrease in the value as well as in the quantity of lobsters landed. In the whole period the value amounted to £137,829, the annual average being £5302. In the first period the average was £5404, and in the second period it was £5199, the decrease thus amounting to 3·8 per cent.

In the Orkney and Shetland group the total value amounted to £149,286, giving an average per annum of £5742. In the first half of the period the total amounted to £58,584, with an average of £4506; in the second half the total was £90,702, and the average £6977. There was thus an increase in value to the extent of about 55 per cent.

On the West Coast the aggregate value amounted to £544,488 for the twenty-six years, the average per annum being £20,942. In the years 1883-1895 the total was £256,896, the average being £19,761; in the years 1896-1908 the total value was £287,592, the average per annum being £22,122. There thus occurred an increase in the value to the extent of about 12 per cent.

The allocation of the value of the lobsters landed to the various coasts in the two periods is shown in the following table:—

	1883-1895.	1896-1908.
East Coast............	18·2 per cent.	15·2 per cent.
Orkney and Shetland ..	15·2 ,,	20·3 ,,
West Coast	66·6 ,,	64·5 ,,

The value or price of lobsters increased over the period covered by the statistics. The average value in shillings per 100 lobsters for the various coasts in quinquennial periods is shown as follows:—

	East Coast.	Orkney and Shetland.	West Coast.	All Scotland.
1884–1888......	101·6	102·6	71·7	79·3
1889–1893......	97·5	100·7	82·2	87·6
1894–1898......	100·0	99·9	78·3	84·6
1899–1903......	110·3	107·7	89·0	90·5
1904–1908......	103·3	101·6	91·0	97·1

The increase in the value on the West Coast, amounting to nearly 27 per cent., is especially noteworthy.

Crabs.

In the statistics referring to crabs, the quantities for the first two years were given in cwts. and in the other years as numbers, so that the whole period for this crustacean in which the figures are comparable comprises 24 years, 1885-1908. In that period the aggregate number of crabs landed amounted to 68,341,417, the average per annum being 2,847,559 crabs. In the first period of eleven years, 1885-1895, the total number amounted to 31,332,471, giving an annual average of 2,848,406; in the second period, 1896-1908, the total number was 37,008,946, the average being 2,846,842. Thus, comparing one period with the other for the whole of Scotland, there has been a fractional and minute decrease. During the first part of the second period, from 1896 to 1902, the number of crabs landed was large, exceeding 3,000,000, but since 1902 the number was smaller, never reaching 3,000,000 in any year, and going as low as 1,990,000 in 1905.

The number landed on the East Coast in the twenty-four years was 64,587,381, the annual average being 2,691,141. In the years 1885-1895 the number amounted to 29,779,515, and the average was 2,707,228 crabs per annum. In the period, 1896-1908, the total number was 34,807,866, the average per annum being 2,677,528. There was thus a slight decrease on the East Coast in the latter period, amounting to about 1·1 per cent. This is accounted for by the comparatively small numbers landed in the years 1905, 1906, and 1907, in each case being under two millions.

The number landed in Orkney and Shetland in the twenty-four years was 434,088, the average per annum being 18,087. In the first eleven years the total was 156,400, and the average 14,218; in the last thirteen years the number was 277,688, and the average 21,360 per annum. There was thus a noteworthy increase in the crabs landed in the islands in the second period, amounting to about 50 per cent. In 1907 the number of crabs taken amounted to 27,294, and in 1908 to 31,500.

There was also an increase in the number of crabs taken on the West Coast. In the whole period the number was 3,319,948, the average per annum being 138,331. In the years 1885-1895 the number was 1,396,556, and the average 126,960; in the second period the number was 1,923,392, and the average 147,953. There was thus an increase of about 16 per cent. so far as concerns quantity.

The proportions of the crabs taken on the different coasts in the two periods are indicated in the following table:—

	1885-1895.	1896-1908.
East Coast............	95 per cent.	94·1 per cent.
Orkney and Shetland ..	0·5 ,,	0·8 ,,
West Coast	4·5 ,,	5·1 ,,

With regard to values, the aggregate value of the crabs landed on the coasts of Scotland in the twenty-four years, 1885-1908, amounted to £421,198, giving an average per annum of £16,200. In the first period, 1885-1895, the total was £209,223, the average being £16,094 per annum; in the second period, 1896-1908, the total was £211,975, while the average per annum was £16,306, showing therefore a small increase of 1·3 per cent. in favour of the latter period. The years of greatest values, as will be seen in the detailed tables, were from 1897 to 1903.

The aggregate value on the East Coast amounted to £401,889, the average per annum being £15,457. In the first period the collective value was £199,062, and the annual average £15,312; in the second period the total value was £202,827, and the average was £15,602. There was thus a slight increase in the value in the second period, amounting to 1·8 per cent.

In Orkney and Shetland the collective value for the whole period was £2368, the annual average being £91; the average in the first period was £66 per annum, and in the second period £116, showing an increase of nearly 66 per cent.

The aggregate value on the West Coast was £16,941, giving an annual average of £651. In the first period the annual average was £716, and in the second period it was £587, showing a decrease of 18 per cent. in value, though there was an increase of nearly the same amount in quantity. The proportion of the value in relation to the different coasts is shown in the following table:—

	1885 - 1895.	1896 - 1908.
East Coast............	95·1 per cent.	95·7 per cent.
Orkney and Shetland ..	0·4 „	0·7 „
West Coast	4 4 „	3·6 „

It is of interest to note that while over the period the value or price of crabs rose on the East Coast, and in particular in Orkney and Shetland, the price declined on the West Coast, as the following table shows :—

	East Coast.	Orkney and Shetland.	West Coast.	All Scotland.
1884–1888......	11·9	6·2	13·6	11·8
1889–1893......	10·0	8·9	8·6	9·2
1894–1898......	10·0	12·0	7·6	9·9
1899–1903......	12·1	10·7	8·8	12·0
1904–1908......	12·6	12·4	7·5	12·2

The figures show the values in shillings per 100 crabs.

Unclassified Shell-fish.

To this division belong a number of shell-fish which, in the order of their value, may be given as follows :—Periwinkles and whelks, limpets, shrimps, cockles, razor-fish or spout-fish (*Solen*), Norway lobster or craw-fish. It appears that the names periwinkle and whelk are given indifferently at different parts of the coast to the same mollusc ; but there is little doubt that the most valuable of the unclassified shell-fish in Scotland is the periwinkle, of which thousands of cwts. are collected from the shores. Shrimp-fishing is confined to the upper parts of the Solway Firth.

Taking all the coasts together, the aggregate quantity of unclassified shell-fish landed in the years 1883 - 1908 amounted to 1,423,060 cwts., giving an average per annum for the period of 54,733 cwts. In the years 1883 - 1895 the total quantity was 718,313 cwts., the average being 55,255 cwts. ; in the years 1896 - 1908 the quantity was 704,747 cwts., the average being 54,211 cwts. per annum. There was thus a slight average decrease, amounting to 1·9 per cent. On the East Coast the aggregate quantity in the twenty-six years amounted to 408,504 cwts., the average per annum being 15,712 cwts. ; in the first half of the period the quantity totalled 222,975 cwts., the average being 17,152 cwts. ; in the second half the total was 185,529 cwts. and the average 14,271 cwts. There thus occurred a decrease of 16·8 per cent. in the quantity on the East Coast.

The aggregate quantity at Orkney and Shetland was 186,777 cwts., giving an annual average for the twenty-six years of 7184 cwts. In the first period the total amounted to 124,356 cwts., the average being 9566 cwts. ; in the second period the total was 62,421, the average being 4802 cwts. There was therefore a decrease in the latter period to the extent of almost 50 per cent.

On the West Coast the total quantity amounted to 827,778 cwts., giving an average of 31,838 cwts. per annum. In the period 1883 - 1895 the quantity was 370,981 cwts, and the average 28,537 cwts. ; in the period 1896–1908 the total amounted to 456,797 cwts., the average being 35,138 cwts. The West Coast thus differs from the other coasts in showing an increase in this class of shell-fish to the extent of about 23 per cent. It is problematical, however, whether an increase in this class is an indication of prosperity. If it consists, as it appears to do, to a large extent of periwinkles and other forms obtained by collection along the shores, it is not unlikely that in periods of scarcity in fisheries proper this method of increasing the means of support is had recourse to.

With regard to values, the total value for the whole period amounted to £331,825, or an average per annum of £12,762. In the years 1883 - 1895 the value amounted to £143,198, and the average to £11,015; in the years 1896 - 1908 the aggregate value was £188,627, the average being £14,510, showing therefore a considerable increase.

The total value on the East Coast was £64,498, the average being £2481; in the first period the average was £2592, and in the second period the average was £2369, showing therefore a small decrease. In Orkney and Shetland the total value amounted to £28,088, the average per annum being £1080. In the first period the average was £1448, and in the second period £713, indicating a considerable decrease. On the West Coast the aggregate value was £239,239, the average per annum being £9201. In the first period the average was £6975, and in the second £11,428, showing a considerable increase.

During the period there has been a fairly steady rise in the price of this class, as shown in the following table, which represents the average value in shillings per cwt. for each quinquennial period :—

	East Coast.	Orkney and Shetland.	West Coast.	All Scotland.
1884–1888	2·9	3·1	5·1	4·0
1889–1893	3·1	3·0	4·4	3·8
1894–1898	3·3	2·7	5·6	4·6
1899–1903	3·4	2·8	6·6	5·4
1904–1908	3·3	3·5	6·7	5·6

TABLE I.—QUANTITY* OF FISH LANDED (IN CWTS.)

1. East Coast.

	Herrings			Sprats	Sparlings	Mackerel				Total Pelagic Fish			
Year	Trawl	Net	Total	Net	Net	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	2,850,925	4,214	—	—	—	—	33	—	—	—	2,855,172
1890	—	—	2,653,903	14,077	—	—	—	—	234	—	—	—	2,668,214
1891	—	—	1,925,962	5,379	206	—	—	—	278	—	—	—	1,931,826
1892	—	2,620,394	2,620,394	5,887	241	—	—	50	50	—	—	2,626,572	2,626,572
1893	—	3,158,346	3,158,346	58,315	347	—	—	57	57	—	—	3,217,066	3,217,066
1894	—	2,827,774	2,827,774	14,877	375	—	—	318	318	—	—	2,843,344	2,843,344
1895	—	2,720,992	2,720,992	12,840	302	—	—	327	327	—	—	2,734,461	2,734,461
1896	—	2,824,977	2,824,977	37,745	494	—	—	571	571	—	—	2,863,787	2,863,787
1897	—	1,503,693	1,503,693	20,950	364	—	—	1,237	1,237	—	—	1,526,244	1,526,244
1898	—	3,047,434	3,047,434	5,939	220	—	—	1,051	1,051	—	—	3,054,644	3,054,644
1899	—	1,522,351	1,522,351	8,323	329	—	—	1,870	1,870	—	—	1,532,873	1,532,873
1900	—	1,528,006	1,528,006	7,349	265	—	—	2,394	2,394	—	—	1,538,014	1,538,014
1901	—	1,926,317	1,926,317	14,904	330	—	—	1,973	1,973	—	—	1,943,524	1,943,524
1902	—	2,740,585	2,740,585	29,064	213	—	—	715	715	—	—	2,770,577	2,770,577
1903	—	2,381,666	2,381,666	60,438	182	—	—	736	736	—	—	2,443,022	2,443,022
1904	—	2,736,602	2,736,602	39,124	287	—	—	1,794	1,794	—	—	2,777,807	2,777,807
1905	—	2,313,253	2,313,253	12,130	527	—	—	6,004	6,004	—	—	2,331,914	2,331,914
1906	456	2,690,795	2,691,251	5,532	230	—	1,033	4,964	5,997	—	1,489	2,701,521	2,703,010
1907	3,784	3,769,840	3,773,624	33,284	240	59	669	3,638	4,366	59	4,453	3,807,002	3,811,514
1908	3,571	2,877,848	2,881,419	11,695	144	125	387	4,027	4,539	125	3,958	2,893,714	2,897,797

	Cod				Ling			Tusk			Saithe		
Year	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	309,473	—	—	33,308	—	—	711	—	—	31,114
1890	—	—	—	290,251	—	—	41,174	—	—	1,277	—	—	39,091
1891	—	—	—	310,020	—	—	40,858	—	—	911	—	—	37,582
1892	257,026	39,568	—	296,594	43,579	2,616	46,195	1,091	—	1,091	29,902	1,660	31,562
1893	223,068	52,965	—	276,033	46,017	4,621	50,638	2,882	—	2,882	26,452	3,054	29,506
1894	228,367	72,778	—	301,145	38,556	3,918	42,474	1,796	—	1,796	33,587	1,741	35,328
1895	257,791	84,243	—	342,034	48,815	4,679	53,494	2,527	—	2,527	25,540	1,499	27,039
1896	290,397	107,139	—	397,536	43,107	7,466	50,573	2,864	—	2,864	38,876	1,637	40,513
1897	304,303	124,576	—	428,879	47,589	5,825	53,414	2,819	—	2,819	33,448	4,056	37,504
1898	263,838	165,593	—	429,431	38,293	10,873	49,166	2,933	—	2,933	39,981	6,870	46,851
1899	232,922	183,652	—	416,574	47,219	24,472	71,691	3,349	—	3,349	28,853	9,880	38,733
1900	156,157	178,593	—	334,750	47,425	37,862	85,287	4,418	—	4,418	23,097	17,550	40,647
1901	150,407	203,099	—	353,506	53,069	47,385	100,454	6,491	—	6,491	15,212	23,675	38,887
1902	143,384	266,716	—	410,100	47,706	43,014	90,720	7,726	—	7,726	12,298	31.163	43,461
1903	142,599	311,928	—	454,527	33,032	41,204	74,236	5,662	1,453	7,115	10,422	39,098	49,520
1904	168,770	380,553	—	549,323	59,655	44,221	103,876	7,478	1,366	8,844	10,354	51,236	61,590
1905	173,958	407,079	—	581,037	60,537	57,941	118,478	8,324	1,813	10,137	13,309	79,450	92,759
1906	142,277	462,476	3,990	608,743	46,863	59,788	106,651	6,302	1,842	8,144	9,968	73,352	83,320
1907	139,113	468,263	3,808	611,184	41,545	80,037	121,582	5,005	1,918	6,923	5,972	96,509	102,481
1908	151,049	521,171	11,296	683,516	95,370	88,140	183,510	10,428	1,825	12,253	15,666	90,414	106,088

8 cwt. Saithe, value £2, caught by net in 1908.

* Fractions omitted.

Year	HADDOCK			WHITING			CONGER EELS			GURNARDS		
	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	725,346	—	—	61,000	—	—	3,846	—	—	—
1890	—	—	683,531	—	—	68,548	—	—	2,559	—	—	—
1891	—	—	672,156	—	—	64,163	—	—	1,762	—	—	—
1892	438,397	209,991	648,388	31,783	7,256	39,039	2,209	77	2,286	—	—	—
1893	390,323	241,762	632,085	20,099	7,371	27,470	2,399	44	2,443	—	—	—
1894	500,680	259,168	759,848	28,688	4,700	33,388	2,374	95	2,469	—	—	—
1895	593,634	337,592	931.226	29,828	5,511	35,339	2,215	95	2,310	—	—	—
1896	600,396	319,013	919,409	27,832	5,585	33,417	3,629	115	3,744	—	—	—
1897	456,062	349,742	805,804	20,532	9,191	29,723	4,589	80	4,669	—	—	—
1898	240,306	461,208	701,514	18,371	16,004	34,375	3,607	61	3,668	—	—	—
1899	181,397	559,850	741,247	18,009	29,206	47,215	3,700	100	3,800	—	—	—
1900	124,090	598,191	722.281	20,349	45,576	65,925	3,763	81	3,844	—	—	—
1901	89,480	706,403	795,883	16,406	98,838	115,244	2,794	126	2,920	—	—	—
1902	103,224	767,137	870,361	13,114	125,123	138,237	1,917	404	2,321	—	—	—
1903	135,917	826,122	962,039	16,437	102,289	118,726	1,743	369	2,112	—	—	—
1904	142,888	837,664	980,552	19,467	125,071	144,538	2,425	250	2,675	162	7,121	7,283
1905	116,274	766,690	882,964	22,868	154,783	177,651	3,032	401	3,433	151	7,378	7,529
1906	159,729	868,137	1,027,988	21,166	119,995	141,327	2,733	299	3,032	175	6,942	7,117
1907	138,010	993,917	1,131,933	11,071	124,372	135,443	2,599	374	2,997	78	6,471	6,549
1908	105,920	984,653	1,090,573	21,540	120,451	141,991	3,346	612	3,996	74	5,091	5,165

122 cwt. Haddock, value £129, caught by net in 1906; 6 cwt. Haddock, value £3, caught by net in 1907. 166 cwt. Whiting, value £44, caught by net in 1906. 24 cwt. Conger Eels, value £56, caught by net in 1907; 38 cwt. Conger Eels, value £82, caught by net in 1908.

Year	CATFISH			MONKS	HAKE			TOTAL ROUND FISH			
	Line	Trawl	Total	Trawl	Line	Trawl	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	1,164,798
1890	—	—	—	—	—	—	—	—	—	—	1,126,431
1891	—	—	—	—	—	—	—	—	—	—	1,127,452
1892	—	—	—	—	—	—	—	803,987	261,168	—	1,065,155
1893	—	—	—	—	—	—	—	711,240	309,817	—	1,021,057
1894	—	—	—	—	—	—	—	834,049	342,400	—	1,176,449
1895	—	—	—	—	—	—	—	960,350	433,619	—	1,393,969
1896	—	—	—	—	—	—	—	1,007,101	440,955	—	1,448,056
1897	—	—	—	—	—	—	—	869,342	493,470	—	1,362,812
1898	—	—	—	—	—	—	—	607,329	660,609	—	1,267,938
1899	—	—	—	—	—	—	—	515,449	807,160	—	1,322,609
1900	—	—	—	—	—	—	—	379,299	877,853	—	1,257,152
1901	—	—	—	—	—	—	—	333,859	1,079,526	—	1,413.385
1902	—	—	—	—	—	—	—	329,369	1,233,557	—	1,562,926
1903	—	—	—	—	—	—	—	345.812	1,322,463	—	1,668,275
1904	436	20,746	21,182	*11,305	171	24,896	25,067	411,808	1,504,427	—	1,916,235
1905	373	17,943	18,316	†13,479	236	33.334	33,570	399,063	1,540,290	—	1,939,353
1906	472	20,196	20,668	14,920	147	25,130	25,277	389.832	1,653,077	4,278	2,047,187
1907	555	23,490	24,045	16,365	71	15,264	15.335	344,019	1,826,980	3,838	2,174,837
1908	709	20,518	21,227	19,992	157	17,840	17,997	404,259	1,870,707	11,342	2,286,308

* Includes 2 cwt. Monks caught by line in 1904.
† ,, 1 ,, ,, ,, ,, ,, ,, 1905.

Year	TURBOT			HALIBUT			LEMON SOLES				FLOUNDERS			
	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	5,764	—	—	7,505	—	—	—	13,127	—	—	—	58,338
1890	—	—	4,639	—	—	10,406	—	—	—	16,382	—	—	—	65.564
1891	—	—	4,395	—	—	7,850	—	—	—	17,570	—	—	—	64,929
1892	230	3,588	3,818	17,242	131	17,373	101	23,156	—	23,257	16,322	39,738	—	56,060
1893	180	3,494	3,674	17,713	556	18,269	131	17,018	—	17,149	16,309	45,744	—	62,053
1894	217	2,463	2,680	19,972	636	20,608	107	17,656	—	17,763	20,144	46,711	—	66,855
1895	81	3,047	3,128	19,389	833	20,222	108	19,061	—	19,169	18,490	47,031	—	65,521
1896	112	4,737	4,849	24,516	839	25,355	87	18,358	—	18,445	12,427	54,132	—	66,559
1897	99	4,322	4,421	22,066	1,278	23,344	67	13,011	—	13,078	14,231	41,531	—	55,762
1898	56	5,587	5,643	17,480	1,520	19,000	60	17,481	—	17,541	14,681	44,595	—	59,276
1899	127	5,988	6,115	14,686	2,746	17,432	42	22,954	—	22,996	19,439	62,210	—	81,649
1900	40	5,003	5,043	16,850	4,837	21,687	23	20,516	—	20,539	17,423	74,633	—	92,056
1901	61	5,081	5,142	23,712	6,665	30,377	40	22,384	—	22,424	18,202	93,868	—	112,070
1902	37	5,385	5,422	19,297	6,706	26,003	65	25,090	—	25,155	17,432	79,109	—	96,541
1903	23	8,692	8,715	19,951	7,399	27,350	139	26,381	—	26,520	15,007	86,703	—	101,710
1904	39	6,539	6,578	26,968	10,641	37,609	157	26,347	—	26,504	9,816	5,433	—	15,249
1905	6	6,212	6,218	20,824	11,061	31,885	135	30,678	—	30,813	6,894	4,673	—	11,567
1906	5	5,459	5,464	21,489	12,679	34,168	140	32.568	81	32,789	4,193	5,143	1,575	10,911
1907	19	5,989	6,008	26,264	13,060	39,324	176	32,704	76	32,956	5,767	2,810	1,031	9,608
1908	6	5,871	5,877	40,152	9,206	49,358	257	33,753	130	34,140	6,132	1,686	946	8,764

"Flounder" includes Plaice and Brill to 1904.

Year	PLAICE				BRILL	‡ DABS			WITCHES	MEGRIMS	TOTAL FLAT FISH			
	Line	Trawl	Net	Total	Trawl	Line	Trawl	Total	Trawl	Trawl	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	84,734
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	96,992
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	94,745
1892	—	—	—	—	—	—	—	—	—	—	33,895	66,614	—	100,509
1893	—	—	—	—	—	—	—	—	—	—	34,333	66,812	—	101,145
1894	—	—	—	—	—	—	—	—	—	—	40,440	67,466	—	107,906
1895	—	—	—	—	—	—	—	—	—	—	38,068	69,972	—	108,040
1896	—	—	—	—	—	—	—	—	—	—	37,142	78,066	—	115,208
1897	—	—	—	—	—	—	—	—	—	—	36,464	60,142	—	96,606
1898	—	—	—	—	—	—	—	—	—	—	32,277	69,183	—	101,460
1899	—	—	—	—	—	—	—	—	—	—	34,294	93,898	—	128,192
1900	—	—	—	—	—	—	—	—	—	—	34,336	104,989	—	139,325
1901	—	—	—	—	—	—	—	—	—	—	42,015	127,998	—	170,013
1902	—	—	—	—	—	—	—	—	—	—	36,831	116,290	—	153,121
1903	—	—	—	—	—	—	—	—	—	—	35,120	129,175	—	164,295
1904	10,745	51,820	—	62,565	*1,408	1,848	4,442	6,290	23,891	10,331	49,594	140,831	—	190,425
1905	7,355	43,741	—	51,096	1,004	1,747	4,391	6,138	21,242	11,610	36,961	134,612	—	171,573
1906	6,218	47,539	1,164	54,921	1,029	2,314	3,802	6,127	16,669	10,697	34,359	135,585	2831	172,775
1907	7,065	41,873	949	49,887	704	2,553	5,922	8,475	17,167	12,640	41,844	132,869	2056	176,769
1908	8,787	35,718	91	44,596	†701	3,066	7,203	10,274	19,679	12,311	58,413	126,115	1172	185,700

* 21 cwt. Brill, value £8, caught by line in 1904. † 13 cwt. Brill, value £11, caught by line in 1908.
‡ 11 ,, Dabs, ,, £5, ,, net in 1906. 5 ,, Dabs, ,, £6, ,, net in 1908.

Year	SKATES AND RAYS				UNCLASSIFIED				TOTAL WHITE FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Net.	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	30,199	—	—	—	65,783	—	—	—	4,200,687
1890	—	—	—	35,281	—	—	—	86,703	—	—	—	4,013,621
1891	—	—	—	32,506	—	—	—	84,347	—	—	—	3,270,877
1892	30,847	6,005	—	36,852	44,475	41,256	—	85,731	913,205	375,043	2,626,572	3,914,820
1893	33,539	5,363	—	38,902	33,193	39,418	1,511	74,122	812,306	421,410	3,218,577	4,452,293
1894	25,999	5,181	—	31,180	23,441	22,768	1,118	47,327	923,930	437,815	2,844,462	4,206,207
1895	29,020	4,882	—	33,902	17,910	17,713	—	35,623	1,045,348	526,186	2,734,461	4,305,995
1896	37,253	6,793	—	44,046	16,238	19,839	—	36,077	1,097,736	545,652	2,863,787	4,507,175
1897	40,296	7,327	—	47,623	13,465	22,274	—	35,739	959,567	583,213	1,526,244	3,069,024
1898	37,563	11,092	—	48,655	9,526	37,847	—	47,373	686,695	778,731	3,054,644	4,520,070
1899	38,518	16,784	—	55,302	5,561	53,368	—	58,929	593,822	971,210	1,532,873	3,097,905
1900	30,627	20,788	—	51,415	4,214	55,531	—	59,745	448,476	1,059,161	1,538,014	3,045,651
1901	34,306	25,639	—	59,945	3,438	77,744	—	81,182	413,618	1,310,907	1,943,524	3,668,049
1902	35,779	27,350	—	63,129	3,051	68,310	—	71,361	405,030	1,445,507	2,770,577	4,621,114
1903	28,541	33,342	—	61,883	2,566	58,699	—	61,265	412,039	1,543,679	2,443,022	4,398,740
1904	39,413	36,693	—	76,106	822	1,910	—	2,732	501,637	1,683,861	2,777,807	4,963,305
1905	40,249	37,794	—	78,043	592	2,719	—	3,311	476,865	1,715,415	2,331,914	4,524,194
1906	34,626	40,707	235	75,568	240	3,530	11	3,781	459,057	1,834,388	2,708,876	5,002,321
1907	32,481	39,176	64	71,721	176	7,149	5	7,330	418,579	2,010,627	3,812,965	6,242,171
1908	49,110	42,901	33	92,044	271	7,905	—	8,176	512,178	2,051,586	2,906,261	5,470,025

2. *Orkney and Shetland.*

Year	HERRING	MACKEREL	TOTAL PELAGIC FISH	COD AND CODLING			LING	TUSK	SAITHE		
	Net	Net		Line	Trawl	Total	Line	Line	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—
1889	189,591	180	189,771	—	—	133,056	53,114	9,702	—	—	27,877
1890	335,632	—	335,632	—	—	106,874	48,964	6,033	—	—	44,483
1891	361,459	18	361,477	—	—	150,485	57,051	5,465	—	—	26,700
1892	163,075	—	163,075	112,063	—	112,063	23,715	3,511	26,450	—	26,450
1893	334,918	1	334,919	95,013	—	95,013	47,037	7,092	29,734	—	29,734
1894	842,960	10	842,970	101,848	4,530	106,378	50,200	5,970	52,757	—	52,757
1895	663,225	—	663,225	79,464	127	79,591	47,732	6,968	30,858	—	30,858
1896	540,880	120	541,000	127,542	2,439	129,981	41,999	6,585	40,148	—	40,148
1897	658,429	320	658,749	103,089	4,763	107,852	30,892	4,131	20,392	—	20,392
1898	782,144	37	782,181	62,899	—	62,899	23,862	4,249	24,784	—	24,784
1899	929,346	387	929,733	37,859	9,186	47,045	30,125	5,572	26,277	—	26,277
1900	1,155,826	281	1,156,107	46,397	12,592	58,989	26,453	4,099	20,704	439	21,143
1901	1,701,878	146	1,702,024	43,918	13,560	57,478	21,998	6,391	21,069	125	21,194
1902	1,199,424	70	1,199,494	33,432	19,566	52,998	8,927	2,805	16,591	—	16,591
1903	1,185,131	48	1,185,179	33,064	16,400	49,464	4,935	2,138	16,818	—	16,818
1904	2,045,613	46	2,045,659	46,120	16,494	62,614	3,253	1,326	13,758	—	13,758
1905	2,409,862	65	2,409,927	41,420	20,379	61,799	8,511	3,963	16,501	620	17,121
1906	1,734,351	700	1,735,051	45,431	29,522	74,953	3,191	1,318	6,403	252	6,655
1907	1,782,023	151	1,782,174	28,560	23,446	52,006	1,373	836	3,629	434	4,063
1908	1,994,202	344	1,994,546	69,894	21,338	91,232	8,370	2,822	6,631	396	7,027

329 cwt. of Ling, value £128, caught by trawl in 1900 (included in line).
402 ,, ,, ,, £153, ,, ,, 1901 ,, ,,
10 ,, ,, ,, £3, ,, ,, 1906 ,, ,,
800 ,, ,, ,, £259, ,, ,, 1908 ,, ,,
5 ,, Tusk, ,, £3, ,, ,, 1906 ,, ,,
10 ,, ,, ,, £5, ,, ,, 1908 ,, ,,

	Haddocks			Whiting	Conger Eels	Catfish	Hake	Total Round Fish			Turbot	Halibut	Lemon Soles	* Flounders
Year	Line	Trawl	Total	Line	Line	Line	Line	Line	Trawl	Total	Line	Line	Line	Line
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	35,480	131	64	—	—	—	—	259,424	5	9,905	—	1,121
1890	—	—	32,626	60	270	—	—	—	—	239,310	50	6,696	—	305
1891	—	—	21,540	—	236	—	—	—	—	261,477	45	7,315	—	309
1892	39,203	—	39,203	25	50	—	—	205,017	—	205,017	12	4,365	—	321
1893	30,071	—	30,071	4	82	—	—	209,033	—	209,033	—	9,478	—	117
1894	27,058	—	27,058	38	23	—	—	237,894	4,530	242,424	1	8,853	—	145
1895	36,788	—	36,788	10	15	—	—	201,835	127	201,962	—	6,757	—	58
1896	30,663	200	30,863	119	39	—	—	247,095	2,639	249,734	2	5,763	—	285
1897	34,096	190	34.286	145	29	—	—	192,774	4,953	197,727	1	4,110	—	409
1898	28,644	—	28,644	157	18	—	—	144,613	—	144,613	—	3,136	—	169
1899	30 280	—	30,280	342	49	—	—	130,504	9,186	139,690	2	2,629	—	262
1900	28,311	530	28,841	387	15	—	—	126,035	13,892	139,927	24	2,220	14	270
1901	26,358	78	26,436	233	—	—	—	119,565	14,165	133,730	2	3,054	1	197
1902	19,800	—	19,800	333	1	—	—	81,889	19,566	101,455	1	1,149	—	293
1903	23,706	—	23,706	126	1	—	—	80,788	16,400	97,188	—	693	4	312
1904	28,955	—	28,955	410	3	10	2	93,837	16,494	110,331	1	1,110	—	359
1905	28,782	140	28,922	577	7	10	30	99,801	21,139	120,940	11	1,627	3	215
1906	22,745	76	22,821	731	2	5	3	79,814	29,865	109,679	3	1,198	2	181
1907	27,596	—	27,596	1,191	—	—	—	63,185	23,880	87,065	2	335	—	125
1908	26,771	—	26,771	1,354	—	8	13	115,045	22,552	137,597	—	1,176	1	70

* Includes Plaice and Brill to 1904.

2 cwt. Whiting, value £1, caught by trawl in 1900 (included in line).
8 ,, Catfish, ,, £4, ,, ,, 1908 ,, ,,
20 ,, Turbot, ,, £60, ,, ,, 1900 ,, ,,
16 ,, Halibut, ,, £30, ,, ,, 1900 ,, ,,
11 ,, Lemon Soles, value £22, caught by trawl in 1900 (included in line).
58 ,, Flounders, ,, £29, ,, ,, 1900 ,, ,,

	Plaice	Dabs	Total Flat Fish	Skates and Rays	Unclassified Kinds	Total White Fish			
Year	Line	Line	Line	Line	Line	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—
1889	—	—	11,031	6,150	13,694	—	—	—	480,070
1890	—	—	7,051	4,592	7,866	—	—	—	594,452
1891	—	—	7,669	3,548	16,260	—	—	—	650,431
1892	—	—	4,698	3,515	3,420	216,650	—	163,075	379,725
1893	—	—	9,595	3,418	4,603	225,019	—	336,549	561,568
1894	—	—	8,999	3,429	3,372	253,694	4,530	842,970	1,101,194
1895	—	—	6,815	4,425	4,526	214,405	127	666,421	880,953
1896	—	—	6,050	2,866	4,449	260,460	2,639	541,000	804,099
1897	—	—	4,520	2,488	6,950	206,732	4,953	658,749	870,434
1898	—	—	3,305	2,496	4,470	154,884	—	782,181	937,065
1899	—	—	2,893	2,387	2,848	138,632	9,186	929,733	1,077,551
1900	—	—	2,528	1,784	2,056	132,292	14,003	1,156,107	1,302,402
1901	—	—	3,254	2,241	4,294	129,354	14,165	1,702,024	1,845,543
1902	—	—	1,443	1,492	3,491	88,315	19,566	1,199,494	1,307,375
1903	—	—	1,009	999	2,549	85,345	16,400	1,185,179	1,286,924
1904	29	128	1,637	1,224	1,544	98,242	16,494	2,045,659	2,160,395
1905	20	97	1,973	1,979	2,737	106,490	21,139	2,409,927	2,537,556
1906	35	63	1,482	980	2,209	84,485	29,865	1,735,051	1,849,401
1907	42	109	613	647	519	64,964	23,880	1,782,174	1,871.018
1908	50	149	1,446	2,282	261	119,022	22,564	1,994,546	2,136,132

10 cwt. Witches, value £5, caught by line in 1904.
105 ,, Flat Fish, ,, £141, ,, trawl in 1900 (included in line).
3 ,, Skates and Rays, value £1, caught by trawl in 1900 (included in line).
12 ,, ,, ,, ,, £6, ,, ,, 1908 ,, ,,
1,630 ,, Unclassified, ,, £154, ,, net 1893 ,, ,,
3,196 ,, ,, ,, £206, ,, ,, 1895 ,, ,,
3 ,, ,, ,, £1, ,, trawl in 1900 ,, ,,

3.—*West Coast*

Year	Herring			Sprats	Sparling	Mackerel	Total Pelagic Fish		
	Trawl	Net	Total	Net	Net	Net	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—
1889	—	—	677,988	157	—	451	—	—	678,597
1890	—	—	990,827	—	—	704	—	—	991,531
1891	—	—	1,252,202	—	26	1,438	—	—	1,253,666
1892	—	871,647	871,647	21	35	3,420	—	875,124	875,124
1893	—	931,326	931.326	4	29	2,842	—	934,202	934,202
1894	—	663,191	663,191	—	16	2,107	—	665,314	665,314
1895	—	693,249	693,249	2	30	1,398	—	694,679	694,679
1896	—	594,424	594,424	1	28	5,550	—	598,003	598,003
1897	—	803,843	803,843	—	43	3,210	—	807,096	807,096
1898	—	874,063	874,063	—	91	4,258	—	878,412	878,412
1899	—	755,381	755,381	600	65	3,249	—	759 295	759,295
1900	—	836,384	836,384	—	64	4,198	—	840,646	840 646
1901	—	710,440	710,440	—	56	4,259	—	714,755	714,755
1902	—	813,935	813,935	—	60	5,382	—	819,377	819,377
1903	—	712,688	712,688	—	49	8,897	—	721,634	721,634
1904	—	650,279	650,279	—	58	14,653	—	664,990	664,990
1905	—	619,662	619,662	—	50	13,672	—	633,384	633,384
1906	731	553,515	554,246	—	41	23,872	731	577,428	578,159
1907	13,910	743,690	757,600	—	19	29,810	13,912	773,317	787,429
1908	17,070	797,423	814,493	—	39	21,282	17,093	818,649	835,814

200 cwt. Mackerel, value £99, caught by line in 1907.
2 ,, ,, ,, £1, ,, trawl in 1907.
72 ,, ,, ,, £51, ,, line in 1908.
23 ,, ,, ,, £11, ,, trawl in 1908.

Year	Cod and Codling				Ling			Tusk	Saithe			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	61,134	—	—	48,059	1,070	—	—	—	25,481
1890	—	—	—	51,817	—	—	79,508	1,270	—	—	—	38,388
1891	—	—	—	53,671	—	—	82,180	1,248	—	—	—	37,146
1892	58,342	8	—	58,350	83,431	—	83,431	1,284	23,254	4	—	23.258
1893	55,089	16	—	55,105	94,167	—	94,167	1,989	23,575	—	—	23,575
1894	39,729	513	—	40,242	77,692	62	77,754	698	15,148	—	—	15,148
1895	37.658	54	—	37,712	63,537	29	63 566	909	25.548	—	—	25,548
1896	47,390	168	—	47,558	37,004	—	37,004	845	49,320	150	—	49,470
1897	53,947	86	—	54,033	75,784	—	75,784	1,186	39,910	215	—	40,125
1898	63,852	123	—	63,975	38,606	—	38,606	1,626	35,747	272	—	36,019
1899	50,888	13	—	50,901	40,595	—	40,595	2,095	36,581	—	—	36.581
1900	40,266	133	—	40,399	45,183	—	45,183	1,504	28,059	10	—	28,069
1901	34,689	8	—	34,697	34,712	—	34,712	1,737	18,420	—	—	18,420
1902	23,295	2	—	23,297	18,767	—	18,767	828	17.529	—	—	17,529
1903	18,401	2,668	—	21,069	13,499	—	13,499	623	17,313	—	—	17,313
1904	34,340	5	—	34,345	24,458	—	24.458	2,341	19,485	—	—	19,485
1905	33,702	392	—	34,094	23,681	267	23,948	2,080	19.334	3	—	19.337
1906	31,362	95	5,118	36,575	21,603	12	21,615	1,512	19.426	123	5,841	25,390
1907	25,102	2,478	4,952	32,532	18.214	1,136	19,358	2.299	18 974	5,868	6,527	31,369
1908	28,322	2,136	12,094	42,552	18,305	706	19.011	2,230	18,553	4,016	7,865	30,434

8 cwt. Ling, value £4, caught by net in 1907.
148 ,, Tusk. ,, £22, ,, trawl in 1907 (included in line).

Year	HADDOCK				WHITING			CONGER EELS			GURNARDS	CATFISH	MONKS
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Line	Trawl
1888	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	31,304	—	—	8,563	—	—	12,320	—	—	—
1890	—	—	—	37,497	—	—	6,914	—	—	11,246	—	—	—
1891	—	—	—	32,591	—	—	6,913	—	—	9,848	—	—	—
1892	35,177	17	—	35,194	10,038	—	10,038	9,279	3	9,282	—	—	—
1893	22,617	10	—	22,627	6,362	—	6,362	12,316	19	12,335	—	—	—
1894	25.273	235	—	25,508	8,101	47	8,148	11,481	40	11,521	—	—	—
1895	33,126	200	—	33,326	8,027	100	8,127	12,019	—	12,019	—	—	—
1896	39,626	300	—	39,926	8,833	—	8,833	12,044	38	12,082	—	—	—
1897	25,769	455	—	26,224	6,833	—	6,833	11,157	80	11,237	—	—	—
1898	18,170	310	—	18,480	5,107	—	5,107	11,207	—	11,207	—	—	—
1899	13,327	44	—	13,371	9,195	7	9,202	11,590	—	11,590	—	—	—
1900	10,134	57	—	10,191	8,671	30	8,701	10,854	—	10,854	—	—	—
1901	8.725	27	—	8,752	7,858	4	7,862	13,237	—	13,237	—	—	—
1902	9,817	31	—	9,848	10,549	11	10,560	9,665	—	9,665	—	—	—
1903	17,350	1,047	—	18,397	10,515	8	10,523	7,436	—	7,436	—	—	—
1904	20,124	23	—	20,147	7,937	—	7,937	12,900	—	12,900	1,509	4	—
1905	19,381	417	—	19,798	6,225	26	6,251	14,792	193	14,985	1,026	—	9
1906	23,449	134	123	23,706	5,519	8	5,559	12,150	21	12,265	785	—	—
1907	22,541	10,435	81	33,057	4,433	898	5,355	14,596	229	14,827	1,904	37	14
1908	25,103	8,833	62	33,998	3,917	478	4,395	22,398	99	22,497	1,279	50	3

32 cwt. Whiting, value £32, caught by net in 1906.
24 ,, ,, ,, £24, ,, ,, 1907.
94 ,, Conger Eels, value £162, caught by net in 1906.
2 ,, ,, ,, ,, £1 ,, ,, 1907.
792 ,, Gurnards, ,, £98, ,, trawl in 1907 (included in line).
198 ,, ,, ,, £21, ,, ,, 1908 ,, ,,
12 ,, Catfish, ,, £4, ,, ,, 1907 ,, ,,
1 ,, ,, ,, £1, ,, ,, 1908 ,, ,,

Year	HAKE				TOTAL ROUND FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	187,931
1890	—	—	—	—	—	—	—	226,640
1891	—	—	—	—	—	—	—	223,597
1892	—	—	—	—	220,805	32	—	220,837
1893	—	—	—	—	216,116	45	—	216,161
1894	—	—	—	—	178,123	897	—	179,020
1895	—	—	—	—	180,824	383	—	181,207
1896	—	—	—	—	195,063	656	—	195,719
1897	—	—	—	—	214,586	836	—	215,422
1898	—	—	—	—	174,315	705	—	175,020
1899	—	—	—	—	164,271	64	—	164,335
1900	—	—	—	—	144,671	230	—	144,901
1901	—	—	—	—	119,378	39	—	119,417
1902	—	—	—	—	90,450	44	—	90,494
1903	—	—	—	—	85,137	3,723	—	88,860
1904	155	—	—	155	123,253	28	—	123,281
1905	109	511	—	620	120,330	1,818	—	122,148
1906	51	—	44	95	115,857	393	11,252	127,502
1907	71	1,541	107	1,719	107,219	23,551	11,701	142,471
1908	71	309	250	630	120,029	16,779	20,271	157,079

Year	TURBOT				HALIBUT			LEMON SOLES			FLOUNDERS			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	569	—	—	3,684	—	—	1,264	—	—	—	14,811
1890	—	—	—	865	—	—	3,129	—	—	269	—	—	—	15,439
1891	—	—	—	575	—	—	3,999	—	—	170	—	—	—	13,538
1892	768	—	—	768	3,541	—	3,541	92	1	93	9,469	5,014	—	14,483
1893	466	—	—	466	3,517	—	3,517	113	6	119	9,125	4,206	—	13,331
1894	418	35	—	453	2,002	8	2,010	83	35	118	9,841	4,338	—	14,179
1895	429	7	—	436	1,972	—	1,972	111	70	181	9,277	4,878	—	14,155
1896	539	—	—	539	2,010	—	2,010	124	41	165	12,300	5,750	—	18,050
1897	552	5	—	557	2,663	—	2,663	97	32	129	10,345	4,195	—	14,540
1898	583	—	—	583	2,417	—	2,417	201	6	207	9,817	3,863	—	13,680
1899	839	—	—	839	2,718	—	2,718	34	—	34	7,153	3,353	—	10,506
1900	503	1	—	504	1,776	—	1,776	67	2	69	6,253	3,642	—	9,895
1901	379	—	—	379	2,698	—	2,698	36	—	36	6,195	3,737	—	9,932
1902	237	—	—	237	1,631	—	1,631	104	12	116	6,131	2,687	—	8,818
1903	280	—	—	280	849	—	849	87	—	87	7,067	2,568	—	9,635
1904	313	—	—	313	2,666	—	2,666	124	5	129	4,563	1,732	—	6,295
1905	218	28	—	246	2,042	9	2,051	34	—	34	4,159	1,365	—	5,524
1906	123	6	103	232	1,304	16	1,320	21	6	37	3,028	426	407	3,861
1907	237	114	93	444	1,317	139	1,456	1	97	98	3,944	456	575	4,975
1908	153	90	89	332	1,761	134	1,895	20	61	85	3,518	321	1,091	4,930

10 cwt. Lemon Soles, value £13, caught by net in 1906.
4 ,, ,, ,, ,, £8, ,, ,, 1908.
Flounders include Plaice and Brill to 1904.

Year	PLAICE				BRILL				DABS			WITCHES	MEGRIMS	TOTAL FLAT FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Total	Trawl	Trawl	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20,329
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	19,702
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	18,282
1892	—	—	—	—	—	—	—	—	—	—	—	—	—	13,871	5,014	—	18,885
1893	—	—	—	—	—	—	—	—	—	—	—	—	—	13,221	4,212	—	17,433
1894	—	—	—	—	—	—	—	—	—	—	—	—	—	12,344	4,416	—	16,760
1895	—	—	—	—	—	—	—	—	—	—	—	—	—	11,789	4,955	—	16,744
1896	—	—	—	—	—	—	—	—	—	—	—	—	—	14,974	5,790	—	20,764
1897	—	—	—	—	—	—	—	—	—	—	—	—	—	13,658	4,232	—	17,890
1898	—	—	—	—	—	—	—	—	—	—	—	—	—	13,019	3,869	—	16,888
1899	—	—	—	—	—	—	—	—	—	—	—	—	—	10,744	3,353	—	14,097
1900	—	—	—	—	—	—	—	—	—	—	—	—	—	8,599	3,645	—	12,244
1901	—	—	—	—	—	—	—	—	—	—	—	—	—	9,308	3,737	—	13,045
1902	—	—	—	—	—	—	—	—	—	—	—	—	—	8,103	2,699	—	10,802
1903	—	—	—	—	—	—	—	—	—	—	—	—	—	8,283	2,568	—	10,851
1904	2,531	1,354	—	3,885	5	—	—	5	403	7	410	2	—	11,959	1,746	—	13,705
1905	3,467	1,666	—	5,133	12	—	—	12	374	12	386	1,415	50	10,306	4,545	—	14,851
1906	1,108	1,412	1,354	3,874	2	—	7	9	286	—	288	38	11	5,872	1,911	1,887	9,670
1907	1,159	1,514	2,098	4,771	—	11	6	17	110	304	414	402	596	6,768	3,633	2,772	13,173
1908	1,566	1,403	1,797	4,766	—	4	6	10	36	44	80	229	442	7,054	2,728	2,987	12,769

2 cwt. Dabs, value £2, caught by net in 1906.
4 ,, Witches, ,, £4, ,, ,, ,, ,, 1906 (included in trawl).

Year	SKATES AND RAYS				UNCLASSIFIED				TOTAL WHITE FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	13,738	—	—	—	7,886	—	—	—	908,481
1890	—	—	—	13,891	—	—	—	4,649	—	—	—	1,256,414
1891	—	—	—	11,022	—	—	—	6,330	—	—	—	1,512,898
1892	13,402	15	—	13,417	13,329	—	—	13,329	261,407	5,062	875,124	1,141,593
1893	15,669	20	—	15,689	10,295	—	376	10,671	255,302	4,277	934,578	1,194,157
1894	14,033	597	—	14,630	5,336	114	198	5,648	209,836	6,024	665,513	881,373
1895	20,893	26	—	20,919	6,392	18	134	6,544	219,898	5,382	694,813	920,093
1896	14,817	3	—	14,820	6,155	2	—	6,157	231,009	6,451	598,004	835,464
1897	15,532	108	—	15,640	6,163	3	—	6,166	249,939	5,179	807,096	1,062,214
1898	22,895	131	—	23,026	7,185	—	101	7,286	217,414	4,705	878,513	1,100,632
1899	25,525	—	—	25,525	6,368	—	—	6,368	206,908	3,417	759,295	969,620
1900	19,269	20	—	19,289	4,109	23	—	4,132	176,648	3,918	840,646	1,021,212
1901	19,646	—	—	19,646	4,715	—	—	4,715	153,047	3,776	714,755	871,578
1902	13,599	14	—	13,613	3,253	—	—	3,253	115,405	2,757	819,377	937,539
1903	8,107	—	—	8,107	3,692	—	—	3,692	105,219	6,291	721,634	833,144
1904	17,738	85	—	17,823	2,265	—	—	2,265	153,861	3,213	664,990	822,064
1905	19,573	521	—	20,094	2,090	—	—	2,090	152,299	6,884	633,384	792,567
1906	20,055	471	301	20,827	2,731	—	—	2,731	144,515	3,506	590,868	738,889
1907	15,409	1,164	560	17,133	1,740	58	—	1,798	131,336	42,318	788,350	962,004
1908	28,809	1,049	124	29,982	1,788	60	—	1,848	157,752	37,709	842,031	1,037,492

4.—*All Coasts.*

Year	HERRING			SPRATS	SPARLINGS	MACKEREL			TOTAL PELAGIC FISH.		
	Trawl	Net	Total	Net	Net	Trawl	Net	Total	Trawl	Net	Total
1888	—	—	2,741,371	15,085	—	—	—	598	—	—	2,757,054
1889	—	—	3,718,505	4,371	—	—	—	664	—	—	3,723,540
1890	—	—	3,980,363	14,077	247	—	—	938	—	—	3,995,625
1891	—	—	3,539,623	5,379	232	—	—	1,734	—	—	3,546,968
1892	—	3,655,116	3,655,116	5,908	276	—	3,471	3,471	—	3,664,771	3,664,771
1893	—	4,424,591	4,424,591	58,319	376	—	2,901	2,901	—	4,486,187	4,486,187
1894	—	4,333,925	4,333,925	14,877	391	—	2,435	2,435	—	4,351,629	4,351,629
1895	—	4,077,466	4,077,466	12,842	332	—	1,725	1,725	—	4,092,365	4,092,365
1896	—	3,960,281	3,960,281	37,746	523	—	4,241	4,241	—	4,002,791	4,002,791
1897	—	2,965,965	2,965,965	20,950	408	—	4,767	4,767	—	2,992,090	2,992,090
1898	—	4,703,641	4,703,641	5,939	311	—	5,346	5,346	—	4,715,237	4,715,237
1899	—	3,207,078	3,207,078	8,923	394	—	5,506	5,506	—	3,221,901	3,221,901
1900	—	3,520,216	3,520,216	7,349	329	—	6,873	6,873	—	3,534,767	3,534,767
1901	—	4,338,635	4,338,635	14,904	386	—	6,378	6,378	—	4,360,303	4,360,303
1902	—	4,753,944	4,753,944	29,064	273	—	6,167	6,167	—	4,789,448	4,789,448
1903	—	4,279,485	4,279,485	60,438	231	—	9,681	9,681	—	4,349,835	4,349,835
1904	—	5,432,494	5,432,494	39,124	345	—	16,493	16,493	—	5,488,456	5,488,456
1905	—	5,342,777	5,342,777	12,130	577	—	19,741	19,741	—	5,375,225	5,375,225
1906	1,187	4,978,661	4,979,848	5,532	271	1,033	29,536	30,569	2,220	5,014,000	5,016,220
1907	17,694	6,295,553	6,313,247	33,284	259	671	33,397	34,327	18,365	6,362,493	6,381,117
1908	20,641	5,669,473	5,690,114	11,695	183	410	25,558	26,165	21,051	5,706,909	5,728,157

259 cwt. Mackerel, value £133, caught by line in 1907.
197 ,, ,, ,, £111, ,, ,, 1908.

Year	COD AND CODLING				LING			TUSK			SAITHE			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Net	Total
1888	—	—	—	469,453	—	—	99,722	—	—	8,727	—	—	—	105,573
1889	—	—	—	503,663	—	—	134,481	—	—	11,483	—	—	—	84,472
1890	—	—	—	448,942	—	—	169,646	—	—	8,580	—	—	—	121,962
1891	—	—	—	514,176	—	—	180,089	—	—	7,624	—	—	—	101,428
1892	427,431	39,576	—	467,007	150,725	2,616	153.341	5,886	—	5,886	79,606	1,664	—	81,270
1893	373,170	52,981	—	426,151	187,221	4,621	191,842	11,963	—	11,963	79,761	3,054	—	82,815
1894	369,945	77,821	—	447,766	166,448	3,980	170,428	8,464	—	8,464	101,492	1,741	—	103,233
1895	374,913	84,424	—	459,337	160,084	4,708	164,792	10,404	—	10,404	81,946	1,499	—	83,445
1896	465,329	109,746	—	575,075	122,110	7,466	129,576	10,294	—	10,294	128,344	1,787	—	130,131
1897	461,339	129,425	—	590,764	154,265	5,825	160,090	8,136	—	8,136	93,750	4,271	—	98,021
1898	390,589	165,716	—	556,305	100,761	10,873	111,634	8,808	—	8,808	100.512	7,142	—	107,654
1899	321,669	192,851	—	514,520	117,939	24,472	142.411	11,016	—	11,016	91,711	9,880	—	101,591
1900	242,820	191,318	—	434,138	118,732	38,191	156,923	10,021	—	10,021	71,860	17,999	—	89,859
1901	229,014	216,667	—	445,681	109,377	47,787	157,164	14,619	—	14,619	54,701	23,800	—	78,501
1902	200,111	286,284	—	486,395	75,400	43,014	118,414	11,359	—	11.359	46,418	31,163	—	77,581
1903	194,064	330,996	—	525,060	51,466	41,204	92,670	8,423	1453	9,876	44.553	39,098	—	83,651
1904	249,230	397,052	—	646,282	87,366	44.221	131,587	11,145	1366	12,511	43,597	51,236	—	94,833
1905	249,080	427,850	—	676,930	92,729	58,208	150,937	14,367	1813	16,180	49,144	80,073	—	129,217
1906	219,070	492,093	9,108	720,271	71,647	59,810	131,457	9,127	1847	10,974	35,797	73,727	5841	115,365
1907	192,775	494,187	8,760	695,722	61,132	81,173	142,313	7,992	2066	10,058	28,575	102,811	6527	137,913
1908	249,265	544,645	23,390	817,300	121,245	89,646	210,891	15,470	1835	17,305	40,850	94,826	7873	143,549

8 cwt. Ling, value £4, caught by net in 1907.

Year	HADDOCK			WHITING			CONGER EELS			GURNARDS		
	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total
1888	—	—	820,498	—	—	76,755	—	—	6,797	—	—	—
1889	—	—	792,130	—	—	69,694	—	—	16,230	—	—	—
1890	—	—	753,654	—	—	75,522	—	—	14,076	—	—	—
1891	—	—	726,287	—	—	71,076	—	—	11,846	—	—	—
1892	512,777	210,008	722,785	41,846	7,256	49,102	11,538	80	11,618	—	—	—
1893	443,011	241,772	684,783	26,465	7,371	33,836	14,798	63	14,861	—	—	—
1894	553,011	259,403	812.414	36,827	4,747	41,574	13,878	135	14,013	—	—	—
1895	663.548	337,792	1,001,340	37,865	5,611	43,476	14,249	95	14,344	—	—	—
1896	670,685	319,513	990,198	36,784	5,585	42.369	15,712	153	15,865	—	—	—
1897	515,927	350,387	866,314	27,510	9,191	36,701	15,775	160	15,935	—	—	—
1898	287,120	461,518	748,638	23.635	16,004	39,639	14,832	61	14,893	—	—	—
1899	225,004	559,894	784,898	27,546	29,213	56,759	15,339	100	15,439	—	—	—
1900	162,535	598,778	761,313	29,405	45,608	75,013	14,632	81	14,713	—	—	—
1901	124,563	706,508	831,071	24,497	98,842	123,339	16,031	126	16,157	—	—	—
1902	132,841	767,168	900,009	23,996	125,134	149,130	11,583	404	11,987	—	—	—
1903	176,973	827,169	1,004,142	27,078	102,297	129,375	9,180	369	9,549	—	—	—
1904	191,967	837,687	1,029,654	27,814	125,071	152.885	15,328	250	15,578	1,671	7,121	8,792
1905	164,437	767,247	931,684	29,670	154,809	184,479	17,831	594	18,425	1,177	7.378	8,555
1906	205,923	868,347	1,074,515	27,416	120,003	147,617	14,885	320	15,299	960	6,942	7,902
1907	188,147	1,004,352	1,192,586	16,695	125,270	141,989	17,195	603	17,824	1,190	7,263	8,453
1908	157,794	993,486	1,151,342	26,811	120,929	147,740	25,744	711	26,493	1,155	5,289	6,444

245 cwt. Haddock, value £229, caught by net in 1906.
87 ,, ,, ,, £63, ,, ,, 1907.
62 ,, ,, ,, £26, ,, ,, 1908.
198 ,, Whiting, ,, £76, ,, ,, 1906.
24 ,, ,, ,, £24, ,, ,, 1907.
94 ,, Conger Eel, ,, £162, ,, ,, 1906.
26 ,, ,, ,, £57, ,, ,, 1907.
38 ,, ,, ,, £82, ,, ,, 1908.

	CATFISH			MONKS	HAKE				TOTAL ROUND FISH			
Year	Line	Trawl	Total	Trawl	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	1,587,525
1889	—	—	—	—	—	—	—	—	—	—	—	1,612,153
1890	—	—	—	—	—	—	—	—	—	—	—	1,592,382
1891	—	—	—	—	—	—	—	—	—	—	—	1,612,527
1892	—	—	—	—	—	—	—	—	1.229,809	261,200	—	1,491,009
1893	—	—	—	—	—	—	—	—	1,136,390	309,862	—	1,446,252
1894	—	—	—	—	—	—	—	—	1,250,066	347,828	—	1,597,892
1895	—	—	—	—	—	—	—	—	1,343,009	434,129	—	1,777,138
1896	—	—	—	—	—	—	—	—	1,449,259	444,250	—	1,893,509
1897	—	—	—	—	—	—	—	—	1,276,702	499,259	—	1,775,961
1898	—	—	—	—	—	—	—	—	926,257	661,314	—	1,587,571
1899	—	—	—	—	—	—	—	—	810,224	816,410	—	1,626,634
1900	—	—	—	—	—	—	—	—	650,005	891,975	—	1,541,981
1901	—	—	—	—	—	—	—	—	572,802	1,093,730	—	1,666,532
1902	—	—	—	—	—	—	—	—	501,708	1,253,167	—	1,754.875
1903	—	—	—	—	—	—	—	—	511,737	1,342,586	—	1,854,323
1904	450	20,746	21,196	11,305	328	24,896	—	25.224	628,898	1,520.949	—	2,149,847
1905	383	17,943	18,326	13,488	375	33,845	—	34,220	619,194	1,563,247	—	2,182,441
1906	477	20,196	20,673	14.920	201	25,130	44	25,375	585,503	1,683.335	15,530	2,284,368
1907	580	23,502	24,082	16.379	142	16,805	107	17.054	514,423	1,874,411	15,539	2,404.373
1908	758	20,527	21,285	19.995	241	18,149	250	18.640	639,333	1,910.038	31,613	2,580.984

	TURBOT				HALIBUT			LEMON SOLES				FLOUNDERS			
Year	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	5,424	—	—	20,197	—	—	—	12,669	—	—	—	*87,184
1889	—	—	—	6,338	—	—	21,094	—	—	—	14.391	—	—	—	74,270
1890	—	—	—	5,554	—	—	20,232	—	—	—	16,651	—	—	—	81,309
1891	—	—	—	5,015	—	—	19,165	—	—	—	17,740	—	—	—	78,776
1892	1,010	3,588	—	4,598	25,148	131	25,279	193	23,157	—	23,350	26.112	44,753	—	70,865
1893	646	3,494	—	4,140	30.708	556	31.264	244	17,024	—	17,268	25,551	49,950	—	75,501
1894	636	2,498	—	3,134	30.827	644	31,471	190	17,691	—	17,881	30,130	51,049	—	81,179
1895	510	3,054	—	3,564	28,118	833	28,951	219	19,131	—	19,350	27,825	51,909	—	79,734
1896	654	4,737	—	5,391	32,289	839	33,128	212	18,398	—	18,610	25,012	59,882	—	84,894
1897	653	4,327	—	4,980	28,839	1,278	30,117	164	13,043	—	13,207	24,985	45,726	—	70,711
1898	639	5,588	—	6,227	23,033	1,520	24,553	261	17,487	—	17,748	24,667	48.458	—	73,125
1899	968	5,988	—	6,956	20,033	2,746	22,779	76	22,954	—	23.030	26.854	65,563	—	92,417
1900	547	5,024	—	5,571	20,830	4,853	25,683	93	20,529	—	20,622	23.888	78,333	—	102,221
1901	442	5,081	—	5,523	29,464	6.665	36,129	77	22,384	—	22,461	24,594	97,605	—	122,199
1902	275	5,385	—	5,660	22,077	6.706	28,783	169	25,102	—	25.271	23,856	81,796	—	105,652
1903	303	8,692	—	8,995	21,493	7,399	28,892	230	26.381	—	26.611	22,386	89,271	—	111,657
1904	353	6,539	—	6,892	30,744	10,641	41,385	281	26,352	—	26,633	14,738	7,165	—	21,903
1905	235	6,240	—	6,475	24.493	11,070	35,563	172	30,678	—	30,850	11.268	6,038	—	17,306
1906	131	5,465	103	5,699	23.991	12,695	36,686	163	32,574	91	32.828	7,402	5,569	1,982	14,953
1907	258	6,103	93	6.454	27,906	13.199	41.105	177	32,801	76	33,054	9,836	3,266	1,606	14,708
1908	159	5.961	89	6,209	43,089	9,340	52,429	278	33,814	134	34,226	9,720	2,007	2,037	13,764

* Includes Plaice and Brill to 1904.

Year	PLAICE				BRILL			DABS			WITCHES	MEGRIMS	TOTAL FLAT FISH			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Trawl	Trawl	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	125,474
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	116,094
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	123,746
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	120,696
1892	—	—	—	—	—	—	—	—	—	—	—	—	52,464	71,629	—	124,093
1893	—	—	—	—	—	—	—	—	—	—	—	—	57,149	71,025	—	128,174
1894	—	—	—	—	—	—	—	—	—	—	—	—	61,784	71,882	—	133,666
1895	—	—	—	—	—	—	—	—	—	—	—	—	56,672	74,927	—	131,599
1896	—	—	—	—	—	—	—	—	—	—	—	—	58,166	83,856	—	142,022
1897	—	—	—	—	—	—	—	—	—	—	—	—	54,641	64,374	—	119,015
1898	—	—	—	—	—	—	—	—	—	—	—	—	48,601	73,052	—	121,653
1899	—	—	—	—	—	—	—	—	—	—	—	—	47,931	97,251	—	145,182
1900	—	—	—	—	—	—	—	—	—	—	—	—	45,358	108,739	—	154,097
1901	—	—	—	—	—	—	—	—	—	—	—	—	54,577	131,735	—	186,312
1902	—	—	—	—	—	—	—	—	—	—	—	—	46,377	118,989	—	165,366
1903	—	—	—	—	—	—	—	—	—	—	—	—	44,412	131,743	—	176,155
1904	13,305	53,174	—	66,479	26	1,387	1,413	2,379	4,449	6,828	23,903	10,331	61,836	143,931	—	205,767
1905	10,842	45,407	—	56,249	12	1,004	1,016	2,218	4,403	6,621	22,657	11,660	49,240	139,157	—	188,397
1906	7,361	48,951	2,518	58,830	2	1,029	1,038	2,663	3,802	6,478	16.707	10,708	41,713	137,496	4,718	183,927
1907	8,266	43,387	3,047	54,700	—	715	721	2,772	6,226	8,998	17,569	13,236	49,215	136,502	4,828	190,545
1908	10,403	37,121	1,888	49,412	13	692	711	3,251	7,247	10,503	19,908	12,753	66,913	128,843	4,159	199,915

7 cwt. of Brill, value £9, caught by net in 1906.
6 ,, ,, ,, £10, ,, ,, 1907.
6 ,, ,, ,, £11, ,, ,, 1908.
13 ,, Dabs, ,, £7, ,, ,, 1906.
5 ,, ,, ,, £6, ,, ,, 1908.
10 ,, Witches, value £5, caught by line in 1904 (included in trawl).
4 ,, ,, ,, £4, landed by net in 1906 (,, ,,).

Year	SKATES AND RAYS				UNCLASSIFIED KINDS				GRAND TOTAL WHITE FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	59,089	—	—	—	104,414	—	—	—	4,633,556
1889	—	—	—	50,087	—	—	—	87,363	—	—	—	5,589,237
1890	—	—	—	53,764	—	—	—	98,971	—	—	—	5,864,488
1891	—	—	—	47,076	—	—	—	106,937	—	—	—	5,433,754
1892	47,764	6,020	—	53,784	57,809	41,256	3,415	102,480	1,387,847	380,105	3,668,186	5,436,138
1893	52,626	5,383	—	58,009	46,461	39,418	3,517	89,396	1,292,626	425,688	4,489,704	6,208,018
1894	43,461	5,778	—	49,239	32,149	22,882	1,316	56,347	1,387,461	448,369	4,352,945	6,188,775
1895	54,338	4,908	—	59,246	25,632	17,731	3,330	46,693	1,479,654	531,695	4,095,695	6,107,044
1896	54,936	6,796	—	61,732	26,842	19,841	—	46,683	1,589,204	554,743	4,002,791	6,146,738
1897	58,316	7,435	—	65,751	26,578	22,277	—	48,855	1,416,237	593,345	2,992,090	5,001,672
1898	62,954	11,223	—	74,177	21,181	37,847	101	59,129	1,058,993	783,437	4,715,338	6,557,768
1899	66,430	16,784	—	83,214	14,777	53,368	—	68,145	939,362	983,813	3,221,901	5,145,076
1900	51,677	20,811	—	72,488	10,376	55,557	—	65,933	757,416	1,077,082	3,534,767	5,369,265
1901	56,193	25,639	—	81,832	12,447	77,744	—	90,191	696,019	1,328,848	4,360,303	6,385,170
1902	50,870	27,364	—	78,234	9,795	68,310	—	78,105	608,750	1,467,830	4,789,448	6,866,028
1903	37,647	33,342	—	70,989	8,807	58,699	—	67,506	602,603	1,566,370	4,349,835	6,518,808
1904	58,375	36,778	—	95,153	4,631	1,910	—	6,541	753,740	1,703,568	5,488,456	7,945,764
1905	61,801	38,315	—	100,116	5,419	2,719	—	8,138	735,654	1,743,438	5,375,225	7,854,317
1906	55,661	41,178	536	97,375	5,180	3,530	11	8,721	688,057	1,867,759	5,034,795	7,590,611
1907	48,537	40,340	624	89,501	2,435	7,207	5	9,647	614,869	2,076,825	6,383,489	9,075,183
1908	80,189	43,962	157	124,308	2,320	7,965	—	10,285	788,952	2,111,859	5,742,838	8,643,649

TABLE II.—VALUE OF FISH LANDED (IN £'s).

1.—East Coast.

	HERRINGS			SPRATS	SPARLINGS	MACKEREL				TOTAL PELAGIC FISH			
Year	Trawl	Net	Total	Net	Net	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	485,539	259	—	—	—	—	28	—	—	—	485,826
1890	—	—	493,859	1,070	—	—	—	—	228	—	—	—	495.157
1891	—	—	572,851	303	1,116	—	—	—	280	—	—	—	574,550
1892	—	510,494	510.494	845	871	—	—	44	44	—	—	512.254	512.254
1893	—	549.959	549,959	4.393	1,444	—	—	62	62	—	—	555.858	555.858
1894	—	478,101	478.101	1.173	1.317	—	—	162	162	—	—	480.753	480.753
1895	—	625,574	625.574	2,756	989	—	—	210	210	—	—	629,529	629,529
1896	—	426.372	426.372	3.771	1.610	—	—	390	390	—	—	432,143	432.143
1897	—	430.574	430.574	2.186	1.612	—	—	674	674	—	—	435.046	435.046
1898	—	588.086	588.086	429	823	—	—	552	552	—	—	589.890	589.890
1899	—	625.693	625.693	1.696	1.159	—	—	1.564	1.564	—	—	630.112	630.112
1900	—	662.191	662.191	1.876	914	—	—	2.996	2.996	—	—	667.977	667.977
1901	—	499.509	499.509	4.488	1.163	—	—	2.425	2,425	—	—	507.585	507.585
1902	—	773.631	773.631	4.935	766	—	—	578	578	—	—	779.910	779.910
1903	—	684.817	684.817	6.079	557	—	—	443	443	—	—	691.896	691.896
1904	—	491.572	491.572	3.776	770	—	—	874	874	—	—	496.992	496.992
1905	—	542.519	542,519	2.840	757	—	—	1,598	1,598	—	—	547,714	547,714
1906	239	810.501	810,740	1.994	411	—	664	1,261	1,925	—	903	814.167	815,070
1907	1,732	1,029,133	1,030,865	8.602	606	34	387	1,019	1,440	34	2.119	1,039.360	1,041,513
1908	1.684	538,071	539.755	2.287	372	60	195	1.320	1.575	60	1,879	542.050	543.989

	COD AND CODLING				LING			TUSK			SAITHE		
Year	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	121,545	—	—	15,208	—	—	138	—	—	4,262
1890	—	—	—	113,670	—	—	17,432	—	—	212	—	—	5,486
1891	—	—	—	133.755	—	—	18,786	—	—	154	—	—	5.556
1892	106,504	19.844	—	126.348	18,021	1,221	19.242	201	—	201	4,439	656	5.095
1893	89,775	24.792	—	114.567	16.524	2.052	18.576	489	—	489	4.172	1,015	5,187
1894	95.670	27,030	—	122.700	15.077	1.571	16.648	325	—	325	4.918	285	5.203
1895	100,955	32.771	—	133.726	14.968	1.601	16.569	370	—	370	3.162	196	3.358
1896	108.189	36.123	—	144.312	13.854	2,210	16.064	419	—	419	4.161	153	4,314
1897	116,657	43,577	—	160.234	15.697	1.926	17.623	525	—	525	3.498	365	3.863
1898	121,679	59.603	—	181.282	14,682	3.897	18,579	549	—	549	4.777	746	5.523
1899	115.735	77.612	—	193.347	18,256	7.989	26.245	751	—	751	4.483	1.276	5.759
1900	84.049	90,254	—	174.303	17.001	11.786	28.787	1.163	—	1.163	3,953	2,336	6.289
1901	80.368	102,327	—	182,695	16.714	14.529	31.243	1,513	—	1.513	2.404	3,114	5.518
1902	79,731	114.610	—	194.341	17.948	13.103	31.051	2.019	—	2,019	2.738	4.862	7.600
1903	70,799	134,177	—	204.976	12,662	13.283	25,945	1.397	387	1,784	2.105	7,168	9,273
1904	73,060	153.432	—	226,492	19.104	12,316	31,420	1,705	325	2,030	2.215	8,810	11.025
1905	80,101	179,756	—	259,857	20,260	15.629	35.889	2,198	445	2,643	2,461	14,726	17.187
1906	73,135	202,163	1,874	277,172	17.268	16.916	34.184	1.732	500	2.232	2,144	14,708	16.852
1907	69,904	211.856	1.577	283.337	15,751	21,833	37,584	1,608	549	2,157	1.443	20.373	21,816
1908	66,120	217,719	4,650	288,489	25,373	19,291	44,664	2.730	466	3,196	2.979	14.868	17.849

Year	HADDOCK			WHITING			CONGER EELS			GURNARDS		
	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	311,062	—	—	18,325	—	—	2,222	—	—	—
1890	—	—	348,647	—	—	26,314	—	—	1,497	—	—	—
1891	—	—	356,162	—	—	24,608	—	—	1,264	—	—	—
1892	249,694	117,845	367,539	15,123	3,423	18,546	1,510	53	1,563	—	—	—
1893	221,262	146,113	367,375	11,749	4,260	16,009	1,483	22	1,505	—	—	—
1894	217,182	134,094	351,276	10,829	3,018	13,847	1,921	55	1,976	—	—	—
1895	248,272	136,727	384,999	10,361	2,616	12,977	1,723	53	1,776	—	—	—
1896	260,637	136,574	397,211	10,778	2,099	12,877	2,164	46	2,210	—	—	—
1897	236,377	177,180	413,557	10,325	4,456	14,781	2,408	35	2,443	—	—	—
1898	158.597	251.184	409,781	10,541	6,927	17,468	2,349	30	2,379	—	—	—
1899	132,853	327,272	460,125	11,436	12,167	23,603	2,097	53	2,150	—	—	—
1900	99,255	384,992	484,247	10,131	18,447	28,578	2,233	47	2,280	—	—	—
1901	71,964	437,545	509,509	9,012	29,740	38,752	1,631	66	1,697	—	—	—
1902	72,360	427,895	500,255	6,898	34,521	41,419	1,168	374	1,542	—	—	—
1903	87,566	385,869	473,435	7,773	29,954	37,727	1,079	173	1,252	—	—	—
1904	87,902	386,033	473,935	9,296	31,105	40,401	1,237	96	1.333	40	1,101	1,141
1905	74,056	432,770	506,826	11,982	52,458	64,440	1,519	149	1,668	39	1,245	1,284
1906	90,441	409,128	499,698	10,857	42,282	53,183	1,463	88	1,551	41	1,041	1,082
1907	83,201	423,413	506,617	6,689	42,784	49,473	1,371	132	1,559	16	1,016	1,032
1908	63,171	430,851	494,022	9,011	41,908	50,919	1,586	193	1,861	17	668	685

Year	CATFISH			MONKS	HAKE			TOTAL ROUND FISH			
	Line	Trawl	Total	Trawl	Line	Trawl	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	472,762
1890	—	—	—	—	—	—	—	—	—	—	513,258
1891	—	—	—	—	—	—	—	—	—	—	540,285
1892	—	—	—	—	—	—	—	395,493	143,041	—	538,534
1893	—	—	—	—	—	—	—	345,454	178,254	—	523,708
1894	—	—	—	—	—	—	—	345,922	166,053	—	511,975
1895	—	—	—	—	—	—	—	379,811	173,964	—	553,775
1896	—	—	—	—	—	—	—	400,202	177,205	—	577,407
1897	—	—	—	—	—	—	—	385,487	227,539	—	613,026
1898	—	—	—	—	—	—	—	313,174	322,387	—	635,561
1899	—	—	—	—	—	—	—	285,611	426,369	—	711,980
1900	—	—	—	—	—	—	—	217,785	507,862	—	725,647
1901	—	—	—	—	—	—	—	183,606	587,321	—	770,927
1902	—	—	—	—	—	—	—	182,862	595,365	—	778,227
1903	—	—	—	—	—	—	—	183,381	571,011	—	754,392
1904	180	5,727	5,907	1,710	74	11,635	11,709	194,813	612,290	—	807,103
1905	113	4,874	4,987	2.599	102	16,156	16,258	192,831	720,807	—	913,638
1906	219	5,929	6,148	2,766	74	15,960	16,034	197,374	711,481	2,047	910,902
1907	263	6,502	6,765	2,553	41	9,498	9,539	180,287	740,509	1,636	922,432
1908	328	4,861	5,189	2,454	110	11,543	11,653	171,425	744,822	4,734	920,981

Year	Turbot			Halibut			Lemon Soles				Flounders			
	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	19,621	—	—	11.480	—	—	—	19.820	—	—	—	43.382
1890	—	—	17.610	—	—	13,377	—	—	—	27,017	—	—	—	58.843
1891	—	—	16.561	—	—	11.653	—	—	—	29,982	—	—	—	58.321
1892	541	13.094	13.635	22.387	221	22.608	161	36.766	—	36.927	9.003	43.145	—	52.148
1893	391	12.382	12.773	20,227	541	20.768	226	28,316	—	28.542	9,097	45.070	—	54.167
1894	477	8.892	9.369	24.602	759	25.361	243	30.075	—	30.318	11.140	47.501	—	58.641
1895	203	11.144	11.347	26.198	1.200	27.398	168	37.267	—	37.435	9.656	57,822	—	67.478
1896	306	14.082	14.388	32.874	1.022	33.896	119	37.457	—	37.576	6.787	66.302	—	73.089
1897	236	13.532	13.768	34,802	1.677	36.479	110	31.474	—	31.584	8.284	56.531	—	64.815
1898	160	16.108	16.268	27.855	2.291	30.146	125	36.644	—	36.769	9.532	59.660	—	69.192
1899	335	18.155	18.490	25.606	4.406	30.012	85	46.802	—	46.887	13.057	79.531	—	92.588
1900	121	17.537	17.658	28.946	8.983	37.929	50	41.396	—	41.446	12.027	89.851	—	101.878
1901	186	19.331	19.517	41.586	12.411	53.997	76	47.909	—	47.985	12.187	112.992	—	125.179
1902	136	19.313	19.449	33.328	11.230	44.558	118	49.143	—	49.261	11.315	100.062	—	111.377
1903	35	31.658	31.693	35.068	12.809	47.877	262	53.214	—	53.476	10.302	124.106	—	134.408
1904	82	22.882	22.964	41.620	17.523	59.143	281	49.515	—	49.796	5.571	6.003	—	11.574
1905	13	20.854	20.867	37.097	18.192	55.289	301	55.010	—	55.311	4.193	5.274	—	9.467
1906	17	17.865	17.882	41.183	22.046	63.229	261	65.172	247	65.680	2.521	5.279	1.368	9.168
1907	43	20.293	20.336	48.348	22.969	71.317	225	68.088	247	68.560	3.792	3.157	845	7.794
1908	17	21.331	21.348	69.169	16.614	85.783	243	69.297	424	69.964	4.098	2.069	525	6,692

Year	Plaice				Brill	Dabs			Witches	Megrims	Total Flat Fish			
	Line	Trawl	Net	Total	Trawl	Line	Trawl	Total	Trawl	Trawl	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	94.303
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	116.847
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	116.517
1892	—	—	—	—	—	—	—	—	—	—	32.093	93.225	—	125.318
1893	—	—	—	—	—	—	—	—	—	—	29.941	86.309	—	116.250
1894	—	—	—	—	—	—	—	—	—	—	36.462	87.227	—	123.689
1895	—	—	—	—	—	—	—	—	—	—	36.225	107.433	—	143.658
1896	—	—	—	—	—	—	—	—	—	—	40.086	118.863	—	158.949
1897	—	—	—	—	—	—	—	—	—	—	43.432	103.214	—	146.646
1898	—	—	—	—	—	—	—	—	—	—	37.672	114.703	—	152.375
1899	—	—	—	—	—	—	—	—	—	—	39.083	148.894	—	187.977
1900	—	—	—	—	—	—	—	—	—	—	41.144	157.767	—	198.911
1901	—	—	—	—	—	—	—	—	—	—	54.035	192.643	—	246.678
1902	—	—	—	—	—	—	—	—	—	—	44.897	179.748	—	224.645
1903	—	—	—	—	—	—	—	—	—	—	45.667	221.787	—	267.454
1904	6,951	75.822	—	82,773	1,997	979	1,577	2,556	24.971	9.359	55.492	209.641	—	265.133
1905	4,721	67.110	—	71,831	1,569	936	1,613	2,549	22.421	10.491	47.261	202.534	—	249.795
1906	4,425	70.494	1.034	75.953	1,654	1.270	1.354	2,629	23.840	10.364	49.677	218.068	2654	270.399
1907	5,695	64.095	836	70.626	1,393	1.403	1,679	3,082	21.571	12.266	59.506	215.511	1928	276.945
1908	7,274	56,548	74	63.896	1.288	1.555	2.185	3.746	20.115	11.249	82.367	200.685	1029	284.081

	SKATES AND RAYS				UNCLASSIFIED				GRAND TOTAL			
Year	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	7,380	—	—	—	13,436	—	—	—	1,073,707
1890	—	—	—	8,745	—	—	—	17,696	—	—	—	1,151,703
1891	—	—	—	9,394	—	—	—	18,751	—	—	—	1,259,497
1892	8,438	1,267	—	9,706	11,689	9,411	760	21,860	447,714	246,944	513,014	1,207,672
1893	8,233	1,012	—	9,245	8,641	9,215	616	18,472	392,269	274,790	556,474	1,223,533
1894	8,189	1,028	—	9,217	6,278	5,557	319	12,154	396,851	259,865	481,072	1,137.788
1895	8,219	1,087	—	9,306	4,415	4,025	—	8,440	428,670	286,509	629,529	1,344,708
1896	10,722	1,435	—	12,157	3,855	5,280	—	9,135	454,865	302,783	432,143	1,189,791
1897	13,176	1,549	—	14,725	3,631	5,694	—	9,325	445,726	337,996	435,046	1,218,768
1898	12,949	2,307	—	15,256	2,721	9,881	—	12,602	366,516	449,278	589,890	1,405,684
1899	12,157	3,958	—	16,115	1,746	15,019	—	16,765	338,597	594,240	630,112	1,562,949
1900	10,565	5,994	—	16,559	1,425	23,034	—	24,459	270,919	694,657	667,977	1,633,553
1901	10,357	6,822	—	17,179	1,249	28,273	—	29,522	249,247	815,059	507,585	1,571,891
1902	10,743	6,466	—	17,209	1,108	23,771	—	24,879	239,610	805,350	779,910	1,824,870
1903	9,139	7,775	—	16,914	937	18,898	—	19,835	239,124	819,471	691,896	1,750,491
1904	11,892	8,242	—	20,134	262	435	—	697	262,459	830,608	496,992	1,590,059
1905	12,160	8,782	—	20,942	150	472	—	622	252,402	932,595	547,714	1,732,711
1906	12,129	9,997	102	22,228	45	694	8	747	259,225	941,143	818,978	2,019,346
1907	11,212	9,761	40	21,013	29	1,002	5	1,036	251,068	968,902	1,042,969	2,262,939
1908	12,183	9,106	18	21,307	81	1,537	—	1,618	266,116	958,029	547,831	1,771,976

2.—*Orkney and Shetland.*

	HERRING	MACKEREL	TOTAL PELAGIC FISH	COD AND CODLING			LING	TUSK	SAITHE		
Year	Net	Net		Line	Trawl	Total	Line	Line	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—
1889	39,844	30	39,874	—	—	30,431	14,471	1,354	—	—	2,844
1890	68,230	—	68,230	—	—	24,529	11,392	858	—	—	4,253
1891	75,924	4	75,928	—	—	36,132	13,031	852	—	—	2,357
1892	31,765	—	31,765	26,858	—	26,858	5,391	565	2,332	—	2,332
1893	69,013	—	69,013	22,762	—	22,762	11,397	1,136	2,554	—	2,554
1894	124,140	2	124,142	21,515	1,603	23,118	11,535	934	4,322	—	4,322
1895	118,742	—	118,742	17,797	74	17,871	9,234	879	2,378	—	2,378
1896	103,215	19	103,234	28,674	914	29,588	8,688	834	2,853	—	2,853
1897	116,502	35	116,537	23,496	1,268	24,764	6,694	582	1,110	—	1,110
1898	146,979	10	146,989	15,449	—	15,449	5,091	550	1,380	—	1,380
1899	263,135	104	263,239	9,811	3,503	13,314	7,857	918	2,098	—	2,098
1900	315,763	102	315,865	12,690	4,408	17,098	7,703	738	1,890	65	1,955
1901	330,002	41	330,043	11,416	5,543	16,959	5,973	919	1,999	19	2,018
1902	316,498	22	316,520	10,217	6,879	17,096	2,558	418	1,560	—	1,560
1903	307,833	11	307,844	10,862	6,962	17,824	1,603	321	1,801	—	1,801
1904	346,817	15	346,832	18,346	6,369	24,715	1,030	218	1,433	—	1,433
1905	608,789	23	608,812	16,278	7,779	24,057	2,539	534	1,816	230	2,046
1906	641,490	106	641,596	17,263	10,916	28,179	1,049	258	790	62	852
1907	586,552	10	586,562	17,811	7,400	25,211	465	203	391	104	495
1908	415,764	20	415,784	20,983	6,111	27,094	2,668	527	731	69	800

	Whiting	Conger Eels	Catfish	Hake	Total Round Fish			Turbot	Halibut	Lemon Soles	Flounders	Haddocks		
Year	Line	Line	Line	Line	Line	Trawl	Total	Line	Line	Line	Line	Line	Trawl	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	29	19	—	—	—	—	57.381	3	5,019	—	423	—	—	8,233
1890	15	97	—	—	—	—	48.896	33	3,662	—	72	—	—	7,752
1891	—	96	—	—	—	—	58,075	36	3,740	—	98	—	—	5,607
1892	5	20	—	—	46,670	—	46,670	17	2,509	—	110	11,499	—	11,499
1893	1	31	—	—	46,523	—	46,523	—	5,019	—	52	8,642	—	8,642
1894	8	10	—	—	45,854	1,603	47,457	1	4,603	—	56	7,530	—	7,530
1895	2	6	—	—	40,995	74	41,069	—	3,309	—	26	10,699	—	10,699
1896	27	15	—	—	48,995	989	49,984	3	2,624	—	113	7,904	75	7,979
1897	34	8	—	—	40,681	1,323	42,004	1	2,044	—	181	8,757	55	8,812
1898	38	6	—	—	30,480	—	30,480	—	1,566	—	82	7,966	—	7,966
1899	86	17	—	—	30.904	3,503	34,407	3	1,617	—	122	10,117	—	10,117
1900	141	5	—	—	34,862	4,787	39,649	63	1,721	23	132	11,824	185	12,009
1901	117	—	—	—	32,681	5,754	38,435	4	1.899	1	112	12,410	39	12,449
1902	159	—	—	—	24.225	6,879	31,104	2	889	—	153	9,313	—	9,313
1903	52	—	—	—	25,771	6,962	32,733	—	591	2	195	11,122	—	11,122
1904	125	1	3	—	33.332	6,369	39,701	1	938	—	197	12,176	—	12,176
1905	141	3	2	9	33,058	8,079	41,137	11	1,324	2	131	11,736	70	11,806
1906	254	1	1	1	29,348	11,013	40.361	3	1,176	2	89	9,737	29	9,766
1907	450	—	—	—	30,718	7,504	38,222	2	422	—	88	11,398	—	11,398
1908	378	—	4	4	34.332	6.448	40,780	—	1,241	1	36	9,305	—	9,305

	Plaice	Dabs	Total Flat Fish	Skates and Rays	Unclassified Kinds	Total White Fish			
Year	Line	Line	Line	Line	Line	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—
1889	—	—	5,445	1.242	947	—	—	—	104,889
1890	—	—	3,777	782	529	—	—	—	122,204
1891	—	—	3,874	526	712	—	—	—	138,485
1892	—	—	2,636	496	321	50,123	—	31,765	81,888
1893	—	—	5,071	455	459	52.354	—	69,167	121,521
1894	—	—	4,660	406	386	51,306	1,603	124,142	177,051
1895	—	—	3,335	490	356	44,970	74	118,948	163,992
1896	—	—	2,740	262	517	52,514	989	103.234	156,737
1897	—	—	2,226	276	615	43,798	1,323	116,537	161,658
1898	—	—	1,648	297	508	32,933	—	146,989	179,922
1899	—	—	1,742	378	470	33.496	3,503	263,239	300,238
1900	—	—	1.939	332	338	37,328	4,930	315,865	358,123
1901	—	—	2,016	319	514	35.530	5,754	330,043	371,327
1902	—	—	1,044	254	343	25,866	6,879	316,520	349,265
1903	—	—	788	140	376	27,065	6,962	307,844	341,871
1904	17	56	1,214	253	187	34,986	6,369	346,832	388,187
1905	13	48	1.529	265	154	35,006	8,079	608,812	651,897
1906	30	23	1,323	186	184	31,041	11,013	641,596	683,650
1907	29	59	600	113	56	31,487	7,504	586,562	625,553
1908	33	66	1.377	357	35	36,095	6.454	415,784	458,333

3.—*West Coast.*

Year	HERRING			SPRATS	SPARLING	MACKEREL	TOTAL PELAGIC FISH		
	Trawl	Net	Total	Net	Net	Net	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—
1889	—	—	191,062	4	—	322	—	—	191,388
1890	—	—	264,983	—	—	297	—	—	265,280
1891	—	—	275,609	—	137	1,168	—	—	276,914
1892	—	213,877	213,877	3	173	1,571	—	215,624	215,624
1893	—	187,345	187,345	1	135	2,182	—	189,663	189,663
1894	—	168,270	168,270	—	82	1,166	—	169,518	169,518
1895	—	174,607	174,607	—	136	889	—	175,632	175,632
1896	—	144,100	144,100	3	175	2,022	—	146,300	146,300
1897	—	160,479	160,479	—	161	1,844	—	162,484	162,484
1898	—	217,337	217,337	—	409	1,817	—	219,563	219,563
1899	—	254,468	254,468	62	309	1,633	—	256,472	256,472
1900	—	265,453	265,453	—	172	1,927	—	267,552	267,552
1901	—	231,523	231,523	—	289	1,951	—	233,763	233,763
1902	—	270,363	270,363	—	260	2,527	—	273,150	273,150
1903	—	252,006	252,006	—	189	3,465	—	255,660	255,660
1904	—	179,152	179,152	—	233	4,951	—	184,336	184,336
1905	—	191,772	191,772	—	194	3,929	—	195,895	195,895
1906	365	196,568	196,933	—	128	7,451	365	204,147	204,512
1907	5,354	193,489	198,843	—	74	7,948	5,354	201,411	206,865
1908	6,789	189,336	196,125	—	165	5,048	6,800	194,487	201,338

Year	COD AND CODLING				LING			TUSK	SAITHE			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	20,124	—	—	16,814	233	—	—	—	4,881
1890	—	—	—	17,788	—	—	21,697	264	—	—	—	5,147
1891	—	—	—	18,724	—	—	25,509	250	—	—	—	5,305
1892	18,353	4	—	18,357	25,263	—	25,263	248	3,674	1	—	3,675
1893	18,517	12	—	18,529	29,135	—	29,135	387	4,070	—	—	4,070
1894	15,620	225	—	15,845	22,637	26	22,663	148	2,930	—	—	2,930
1895	15,505	45	—	15,550	17,005	12	17,017	196	3,777	—	—	3,777
1896	17,145	104	—	17,249	10,923	—	10,923	167	5,256	28	—	5,284
1897	16,470	55	—	16,525	21,657	—	21,657	232	4,957	33	—	4,990
1898	19,795	90	—	19,885	11,572	—	11,572	402	4,708	35	—	4,743
1899	16,942	11	—	16,953	12,601	—	12,601	495	4,565	—	—	4,565
1900	14,476	81	—	14,557	14,720	—	14,720	394	3,961	3	—	3,364
1901	13,229	8	—	13,237	11,323	—	11,323	484	3,104	—	—	3,104
1902	11,066	2	—	11,068	7,048	—	7,048	230	3,506	—	—	3,506
1903	9,592	740	—	10,332	5,019	—	5,019	152	3,932	—	—	3,932
1904	15,553	5	—	15,558	8,857	—	8,857	581	3,943	—	—	3,943
1905	14,427	250	—	14,677	9,129	60	9,189	443	3,913	1	—	3,914
1906	14,055	52	2,655	16,762	8,636	6	8,642	332	3,741	31	1,257	5,029
1907	12,376	1,006	2,413	15,795	7,594	338	7,936	589	3,872	799	1,385	6,056
1908	12,772	881	3,675	17,328	7,107	242	7,349	487	3,654	497	1,396	5,547

Year	HADDOCK				WHITING			CONGER EELS			GURNARDS	CAT-FISH	MONKS
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Line	Trawl
1888	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	11,920	—	—	5,432	—	—	6,311	—	—	—
1890	—	—	—	13,853	—	—	4,511	—	—	5,433	—	—	—
1891	—	—	—	13,788	—	—	4,881	—	—	4,824	—	—	—
1892	15,224	15	—	15,239	7,066	—	7,066	4,533	1	4,534	—	—	—
1893	11,421	9	—	11,430	4,703	—	4,703	6,189	29	6,218	—	—	—
1894	13,224	145	—	13,369	6,202	29	6,231	5,261	55	5,316	—	—	—
1895	13,721	187	—	13,908	5,564	98	5,662	6,246	—	6,246	—	—	—
1896	15,097	198	—	15,295	5,568	—	5,568	5,575	80	5,655	—	—	—
1897	12,451	339	—	12,790	4,318	—	4,318	5,850	217	6,067	—	—	—
1898	9,305	268	—	9,573	3,699	—	3,699	5,777	—	5,777	—	—	—
1899	7,835	39	—	7,874	7,253	7	7,260	5,659	—	5,659	—	—	—
1900	6,355	49	—	6,404	6,804	21	6,825	5,480	—	5,480	—	—	—
1901	5,686	27	—	5,713	6,058	4	6,062	4,932	—	4,932	—	—	—
1902	6,370	32	—	6,402	8,465	12	8,477	4,387	—	4,387	—	—	—
1903	9,183	258	—	9,441	8,123	10	8,133	3,964	—	3,964	—	—	—
1904	10,365	23	—	10,388	5,549	—	5,549	5,971	—	5,971	340	2	—
1905	10,002	316	—	10,318	4,481	18	4,499	6,152	61	6,213	217	—	3
1906	12,264	86	100	12,450	3,972	3	4,007	5,925	8	6,095	173	—	—
1907	11,527	3,661	60	15,248	3,015	379	3,418	6,946	62	7,009	374	9	2
1908	12,424	3,322	26	15,772	2,991	191	3,182	8,803	28	8,831	261	6	1

Year	HAKE				TOTAL ROUND FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	65,715
1890	—	—	—	—	—	—	—	68,693
1891	—	—	—	—	—	—	—	73,281
1892	—	—	—	—	74,361	21	—	74,382
1893	—	—	—	—	74,422	50	—	74,472
1894	—	—	—	—	66,022	480	—	66,502
1895	—	—	—	—	62,014	342	—	62,356
1896	—	—	—	—	59,731	410	—	60,141
1897	—	—	—	—	65,935	644	—	66,579
1898	—	—	—	—	55,258	393	—	55,651
1899	—	—	—	—	55,350	57	—	55,407
1900	—	—	—	—	52,190	154	—	52,344
1901	—	—	—	—	44,816	39	—	44,855
1902	—	—	—	—	41,072	46	—	41,118
1903	—	—	—	—	39,965	1,008	—	40,973
1904	122	—	—	122	51,283	28	—	51,311
1905	101	227	—	328	48,865	936	—	49,801
1906	47	—	24	71	49,145	186	4,230	53,561
1907	44	465	67	576	46,222	6,836	3,954	57,012
1908	43	115	160	318	48,526	5,299	5,257	59,082

	TURBOT				HALIBUT			LEMON SOLES			FLOUNDERS			
Year	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	848	—	—	1,997	—	—	2,105	—	—	—	9,267
1890	—	—	—	816	—	—	1,606	—	—	369	—	—	—	9,272
1891	—	—	—	618	—	—	1,768	—	—	241	—	—	—	8,684
1892	858	—	—	858	2,052	—	2,052	219	9	228	5,400	3,790	—	9,190
1893	621	—	—	621	2,268	—	2,268	275	10	285	5,130	3,462	—	8,592
1894	542	163	—	705	1,452	9	1,461	151	122	273	5,866	3,239	—	9,105
1895	520	16	—	536	1,468	—	1,468	135	83	218	5,705	4,120	—	9,825
1896	637	—	—	637	1,362	—	1,362	177	53	230	8,539	4,142	—	12,681
1897	580	10	—	590	1,653	—	1,653	147	47	194	7,349	3,614	—	10,963
1898	636	—	—	636	1,346	—	1,346	171	9	180	7,097	3,536	—	10,633
1899	699	—	—	699	1,612	—	1,612	82	—	82	4,374	2,459	—	6,833
1900	602	2	—	604	1,151	—	1,151	216	3	219	4,161	3,658	—	7,819
1901	585	—	—	585	2,399	—	2,399	145	—	145	4,768	4,175	—	8,943
1902	389	—	—	389	1,942	—	1,942	420	23	443	5,052	2,478	—	7,530
1303	388	—	—	388	718	—	718	263	—	263	5,336	2,491	—	7,827
1904	377	—	—	377	2,614	—	2,614	140	7	147	2,442	1,756	—	4,198
1905	317	118	—	435	1,859	14	1,873	66	—	66	1,994	1,349	—	3,343
1906	58	20	234	312	1,351	40	1,391	21	6	40	1,350	430	259	2,039
1907	125	283	224	632	1,331	277	1,608	1	163	164	1,608	335	372	2,315
1908	45	256	173	474	2,159	280	2,439	48	113	169	1,548	344	687	2,579

	PLAICE				BRILL				DABS			WITCHES	MEGRIMS	TOTAL FLAT FISH			
Year	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Total	Trawl	Trawl	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	14,217
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12,063
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	11,311
1892	—	—	—	—	—	—	—	—	—	—	—	—	—	8,529	3,790	—	12,319
1893	—	—	—	—	—	—	—	—	—	—	—	—	—	8,294	3,472	—	11,766
1894	—	—	—	—	—	—	—	—	—	—	—	—	—	8,011	3,533	—	11,544
1895	—	—	—	—	—	—	—	—	—	—	—	—	—	7,828	4,219	—	12,047
1896	—	—	—	—	—	—	—	—	—	—	—	—	—	10,715	4,195	—	14,910
1897	—	—	—	—	—	—	—	—	—	—	—	—	—	9,729	3,671	—	13,400
1898	—	—	—	—	—	—	—	—	—	—	—	—	—	9,250	3,545	—	12,795
1899	—	—	—	—	—	—	—	—	—	—	—	—	—	6,767	2,459	—	9,226
1900	—	—	—	—	—	—	—	—	—	—	—	—	—	6,130	3,663	—	9,793
1901	—	—	—	—	—	—	—	—	—	—	—	—	—	7,897	4,175	—	12,072
1902	—	—	—	—	—	—	—	—	—	—	—	—	—	7,803	2,501	—	10,304
1903	—	—	—	—	—	—	—	—	—	—	—	—	—	6,705	2,491	—	9,196
1904	2,279	1,480	—	3,759	8	—	—	8	156	4	160	2	—	9,496	1,770	—	11,266
1905	3,215	2,009	—	5,224	16	—	—	16	104	9	113	1,390	40	7,571	4,929	—	12,500
1906	1,104	1,656	1,508	4,268	3	—	9	12	74	—	76	41	10	3,961	2,199	2,029	8,189
1907	1,277	1,647	2,410	5,334	—	22	10	32	40	62	102	220	185	4,382	3,194	3,016	10,592
1908	1,670	1,519	2,285	5,474	—	8	11	19	16	13	29	111	162	5,486	2,806	3,164	11,456

Year	SKATES AND RAYS				UNCLASSIFIED				TOTAL WHITE FISH			
	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	2,253	—	—	—	2,006	—	—	—	275,579
1890	—	—	—	2,150	—	—	—	1,253	—	—	—	349,439
1891	—	—	—	1,593	—	—	—	1,413	—	—	—	364,512
1892	1,781	4	—	1,785	1,876	—	—	1,876	86,547	3,824	215,624	305,995
1893	2,037	3	—	2,040	1,780	—	121	1.901	86,533	3,525	189,784	279,842
1894	2,006	99	—	2,105	1,144	37	132	1,313	77,183	4,149	169,650	250,982
1895	3,670	10	—	3,680	1,477	11	88	1,576	74,989	4,582	175,720	255,291
1896	2,509	2	—	2,511	1,412	1	—	1,413	74,367	4,608	146,300	225,275
1897	3,229	20	—	3,249	1,614	2	—	1,616	80,507	4,337	162,484	247,328
1898	4,727	17	—	4,744	1,429	—	78	1,507	70,664	3,955	219,641	294,260
1899	4,279	—	—	4,279	1,362	—	—	1,362	67,758	2,516	256,472	326,746
1900	3,765	3	—	3,768	841	20	—	861	62,926	3,840	267,552	334,318
1901	3,412	—	—	3,412	990	—	—	990	57,115	4,214	233,763	295,092
1902	3,167	4	—	3,171	790	—	—	790	52,832	2,551	273,150	328,533
1903	2,152	—	—	2,152	944	—	—	944	49,766	3,499	255,660	308,925
1904	3,836	79	—	3,915	605	—	—	605	63,740	3,357	184,336	251,433
1905	4,175	198	—	4,373	591	—	—	591	61,202	6.063	195,895	263,160
1906	5,433	164	84	5,681	716	—	—	716	59,255	2,914	210,490	272,659
1907	4,711	378	177	5,266	454	15	—	469	55,868	15,778	208,558	280,204
1908	8,302	279	25	8,606	387	17	—	404	62,752	15,201	202,953	280,886

4.—All Coasts.

Year	HERRING			SPRATS	SPARLINGS	MACKEREL			TOTAL PELAGIC FISH		
	Trawl	Net	Total	Net	Net	Trawl	Net	Total	Trawl	Net	Total
1888	—	—	551,026	807	—	—	—	397	—	—	552,230
1889	—	—	716,445	263	—	—	—	380	—	—	717,088
1890	—	—	827,072	1,070	885	—	—	525	—	—	829,552
1891	—	—	923,754	303	1,253	—	—	1,452	—	—	926,762
1892	—	756,136	756,136	848	1,044	—	1,615	1,615	—	759,643	759,643
1893	—	806,317	806,317	4,394	1,579	—	2,244	2,244	—	814,534	814,534
1894	—	770,511	770,511	1,173	1,399	—	1,330	1,330	—	774,413	774,413
1895	—	918,923	918,923	2,756	1,125	—	1,099	1,099	—	923,903	923,903
1896	—	673,687	673,687	3,774	1,785	—	2,431	2,431	—	681,677	681,677
1897	—	707,555	707,555	2,186	1,773	—	2,553	2,553	—	714,067	714,067
1898	—	952,402	952,402	429	1,232	—	2,379	2,379	—	956,442	956,442
1899	—	1,143,296	1,143,296	1,758	1,468	—	3,301	3,301	—	1,149,823	1,149,823
1900	—	1,243,407	1,243,407	1,876	1,086	—	5,025	5,025	—	1,251,394	1,251,394
1901	—	1,061,034	1,061,034	4,488	1,452	—	4,417	4,417	—	1,071,391	1,071,391
1902	—	1,360,492	1,360,492	4,935	1,026	—	3,127	3,127	—	1,369,580	1,369,580
1903	—	1,244,656	1,244,656	6,079	746	—	3,919	3,919	—	1,255,400	1,255,400
1904	—	1,017,541	1,017,541	3,776	1,003	—	5,840	5,840	—	1,028,160	1,028,160
1905	—	1,343,080	1,343,080	2,840	951	—	5,550	5,550	—	1,352,421	1,352,421
1906	604	1,648,559	1,649,163	1,994	539	664	8.818	9,482	1,268	1,659,910	1,661,178
1907	7,086	1,809,174	1,816,260	8,602	680	388	8,877	9,398	7,474	1,827,333	1,834,940
1908	8,473	1,143,171	1,151,644	2,287	537	206	6,326	6,643	8,679	1,152,321	1,161,111

Year	COD AND CODLING				LING			TUSK			SAITHE			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Net	Total
1888	—	—	—	205,794	—	—	49,083	—	—	3,478	—	—	—	19,064
1889	—	—	—	172,100	—	—	46,493	—	—	1,725	—	—	—	11,987
1890	—	—	—	155,987	—	—	50,521	—	—	1,334	—	—	—	14,886
1891	—	—	—	188,611	—	—	57,326	—	—	1,256	—	—	—	13,218
1892	151,715	19,848	—	171,563	48,676	1,220	49,896	1,014	—	1,014	10,445	657	—	11,102
1893	131,054	24,804	—	155,858	57,056	2,052	59,108	2,012	—	2,012	10,796	1,015	—	11,811
1894	132,805	28,858	—	161,663	49,249	1,597	50,846	1,407	—	1,407	12,170	285	—	12,455
1895	134,257	32,890	—	167,147	41,207	1,613	42,820	1,445	—	1,445	9,317	196	—	9,513
1896	154,008	37,141	—	191,149	33,465	2,210	35,675	1,420	—	1,420	12,270	181	—	12,451
1897	156,623	44,900	—	201,523	44,048	1,926	45,974	1,339	—	1,339	9,565	398	—	9,963
1898	156,923	59,693	—	216,616	31,345	3,897	35,242	1,501	—	1,501	10,865	781	—	11,646
1899	142,488	81,126	—	223,614	38,714	7,989	46,703	2,164	—	2,164	11,146	1,276	—	12,422
1900	111,215	94,743	—	205,958	39,296	11,914	51,210	2,295	—	2,295	9,804	2,404	—	12,208
1901	105,013	107,878	—	212,891	33,857	14,682	48,539	2,916	—	2,916	7,507	3,133	—	10,640
1902	101,014	121,491	—	222,505	27,554	13,103	40,657	2,667	—	2,667	7,804	4,862	—	12,666
1903	91,253	141,879	—	233,132	19,284	13,283	32,567	1,870	387	2,257	7,838	7,168	—	15,006
1904	106,959	159,806	—	266,765	28,991	12,316	41,307	2,504	325	2,829	7,591	8,810	—	16,401
1905	110,806	187,785	—	298,591	31,928	15,689	47,617	3,175	445	3,620	8,190	14,957	—	23,147
1906	104,453	213,131	4,529	322,113	26,950	16,925	43,875	2,319	503	2,822	6,675	14,801	1,257	22,733
1907	100,091	220,262	3,990	324,343	23,810	22,171	45,985	2,378	571	2,949	5,706	21,276	1,385	28,367
1908	99,875	224,711	8,325	332,911	34,889	19,792	54,681	3,739	471	4,210	7,364	15,434	1,398	24,196

Year	HADDOCK			WHITING			CONGER EELS			GURNARDS		
	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total	Line	Trawl	Total
1888	—	—	333,134	—	—	25,637	—	—	3,689	—	—	—
1889	—	—	331,215	—	—	23,786	—	—	8,552	—	—	—
1890	—	—	370,252	—	—	30,840	—	—	7,027	—	—	—
1891	—	—	375,557	—	—	29,489	—	—	6,184	—	—	—
1892	276,417	117,860	394,277	22,194	3,422	25,617	6,063	54	6,117	—	—	—
1893	241,325	146,122	387,447	16,453	4,260	20,713	7,703	51	7,754	—	—	—
1894	237,936	134,239	372,175	17,039	3,047	20,086	7,192	110	7,302	—	—	—
1895	272,692	136,914	409,606	15,927	2,714	18,641	7,975	53	8,028	—	—	—
1896	283,638	136,847	420,485	16,373	2,099	18,472	7,754	126	7,880	—	—	—
1897	257,585	177,574	435,159	14,677	4,456	19.133	8,266	252	8,518	—	—	—
1898	175,868	251,452	427,320	14,278	6,927	21,205	8.132	30	8,162	—	—	—
1899	150,805	327,311	478,116	18,775	12,174	30,949	7,773	53	7,826	—	—	—
1900	117,434	385,226	502,660	17,075	18,469	35,544	7,718	47	7,765	—	—	—
1901	90,060	437,611	527,671	15,187	29,744	44,931	6,563	66	6,629	—	—	—
1902	88,043	427,927	515,970	15,522	34,533	50,055	5,555	374	5,929	—	—	—
1903	107,871	386,127	493,998	15,948	29,964	45,912	5,043	173	5,216	—	—	—
1904	110,443	386,056	496,499	14,970	31,105	46,075	7,209	96	7,305	380	1,101	1,481
1905	95,794	433,156	528,950	16,604	52,476	69,080	7,674	210	7,884	256	1,245	1,501
1906	112,442	409,243	521,914	15,083	42,285	57,444	7,389	96	7,647	214	1,041	1,255
1907	106,126	427,074	533,263	10,154	43,163	53,341	8,317	194	8,568	292	1,114	1,406
1908	84,900	434,173	519,099	12,380	42,099	54,479	10,389	221	10,692	257	689	946

Year	CATFISH			MONKS	HAKE				TOTAL ROUND FISH			
	Line	Trawl	Total	Trawl	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	639,879
1889	—	—	—	—	—	—	—	—	—	—	—	595,858
1890	—	—	—	—	—	—	—	—	—	—	—	630,847
1891	—	—	—	—	—	—	—	—	—	—	—	671,641
1892	—	—	—	—	—	—	—	—	516,524	143,062	—	659,586
1893	—	—	—	—	—	—	—	—	466,399	178,304	—	644,703
1894	—	—	—	—	—	—	—	—	457,798	168,136	—	625,934
1895	—	—	—	—	—	—	—	—	482,820	174,380	—	657,200
1896	—	—	—	—	—	—	—	—	508,928	178,604	—	687,532
1897	—	—	—	—	—	—	—	—	492,103	229,506	—	721,609
1898	—	—	—	—	—	—	—	—	398,912	322,780	—	721,692
1899	—	—	—	—	—	—	—	—	371,865	429,929	—	801,794
1900	—	—	—	—	—	—	—	—	304,837	512,803	—	817,640
1901	—	—	—	—	—	—	—	—	261,103	593,114	—	854,217
1902	—	—	—	—	—	—	—	—	248,159	602,290	—	850,449
1903	—	—	—	—	—	—	—	—	249,107	578,981	—	828,088
1904	185	5,727	5,912	1,710	196	11,635	—	11,831	279,428	618,687	—	898,115
1905	115	4,874	4,989	2,602	212	16,383	—	16,595	274,754	729,822	—	1,004,576
1906	220	5,929	6,149	2,766	122	15,960	24	16,106	275,867	722,680	6,277	1,004,824
1907	268	6,506	6,774	2,555	85	9,963	67	10,115	257,227	754,849	5,590	1,017,666
1908	333	4,866	5,199	2,455	157	11,658	160	11,975	254,283	756,569	9,991	1,020,843

Year	TURBOT				HALIBUT			LEMON SOLES				FLOUNDERS			
	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	16,310	—	—	19,721	—	—	—	16,512	—	—	—	55,918
1889	—	—	—	20,472	—	—	18,496	—	—	—	21,925	—	—	—	53,072
1890	—	—	—	18,459	—	—	18,645	—	—	—	27,386	—	—	—	68,187
1891	—	—	—	17,215	—	—	17,161	—	—	—	30,223	—	—	—	67,103
1892	1,416	13,094	—	14,510	26,948	221	27,169	380	36,775	—	37,155	14,513	46,935	—	61,448
1893	1,012	12,382	—	13,394	27,514	541	28,055	501	28,326	—	28,827	14,279	48,532	—	62,811
1894	1,020	9,055	—	10,075	30,657	768	31,425	394	30,197	—	30,591	17,062	50,740	—	67,802
1895	723	11,160	—	11,883	30,975	1,200	32,175	303	37,350	—	37,653	15,387	61,942	—	77,329
1896	946	14,082	—	15,028	36,860	1,022	37,882	296	37,510	—	37,806	15,439	70,444	—	85,883
1897	817	13,542	—	14,359	38,499	1,677	40,176	257	31,521	—	31,778	15,814	60,145	—	75,959
1898	796	16,108	—	16,904	30,767	2,291	33,058	296	36,653	—	36,949	16,711	63,196	—	79,907
1899	1,037	18,155	—	19,192	28,835	4,406	33,241	167	46,802	—	46,969	17,553	81,990	—	99,543
1900	726	17,599	—	18,325	31,788	9,013	40,801	267	41,421	—	41,688	16,291	93,538	—	109,829
1901	775	19,331	—	20,106	45,884	12,411	58,295	222	47,909	—	48,131	17,067	117,167	—	134,234
1902	527	19,313	—	19,840	36,159	11,230	47,389	538	49,166	—	49,704	16,520	102,540	—	119,060
1903	423	31,658	—	32,081	36,377	12,809	49,186	527	53,214	—	53,741	15,833	126,597	—	142,430
1904	460	22,882	—	23,342	45,172	17,523	62,695	421	49,522	—	49,943	8,210	7,759	—	15,969
1905	341	20,972	—	21,313	40,280	18,206	58,486	369	55,010	—	55,379	6,318	6,623	—	12,941
1906	78	17,885	234	18,197	43,710	22,086	65,796	284	65,178	260	65,722	3,960	5,709	1,627	11,296
1907	170	20,576	224	20,970	50,101	23,246	73,347	226	68,251	247	68,724	5,488	3,492	1,217	10,197
1908	62	21,587	173	21,822	72,569	16,894	89,463	292	69,410	432	70,134	5,682	2,413	1,212	9,307

	Plaice				Brill			Dabs			Witches	Megrims	Total Flat Fish			
Year	Line	Trawl	Net	Total	Line	Trawl	Total	Line	Trawl	Total	Trawl	Trawl	Line	Trawl	Net	Total
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	108,461
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	113,965
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	132,677
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	131,702
1892	—	—	—	—	—	—	—	—	—	—	—	—	43,258	97,024	—	140,282
1893	—	—	—	—	—	—	—	—	—	—	—	—	43,306	89,781	—	133,087
1894	—	—	—	—	—	—	—	—	—	—	—	—	49,133	90,760	—	139,893
1895	—	—	—	—	—	—	—	—	—	—	—	—	47,388	111,652	—	159,040
1896	—	—	—	—	—	—	—	—	—	—	—	—	53,541	123,058	—	176,599
1897	—	—	—	—	—	—	—	—	—	—	—	—	55,387	106,885	—	162,272
1898	—	—	—	—	—	—	—	—	—	—	—	—	48,570	118,248	—	166,818
1899	—	—	—	—	—	—	—	—	—	—	—	—	47,592	151,353	—	198,945
1900	—	—	—	—	—	—	—	—	—	—	—	—	49,072	161,571	—	210,643
1901	—	—	—	—	—	—	—	—	—	—	—	—	63,948	196,818	—	260,766
1902	—	—	—	—	—	—	—	—	—	—	—	—	53,744	182,249	—	235,993
1903	—	—	—	—	—	—	—	—	—	—	—	—	53,160	224,278	—	277,438
1904	9,247	77,302	—	86,549	16	1,989	2,005	1,191	1,581	2,772	24,979	9,359	64,722	212,891	—	277,613
1905	7,949	69,119	—	77,068	16	1,569	1,585	1,088	1,622	2,710	23,811	10,531	56,361	207,463	—	263,824
1906	5,559	72,150	2,542	80,251	3	1,654	1,666	1,367	1,354	2,728	23,881	10,374	54,961	220,267	4,683	279,911
1907	7,001	65,742	3,246	75,989	—	1,415	1,425	1,502	1,741	3,243	21,791	12,451	64,488	218,705	4,944	288,137
1908	8,977	58,067	2,359	69,403	11	1,285	1,307	1,637	2,198	3,841	20,226	11,411	89,230	203,491	4,193	296,914

	Skates and Rays				Unclassified Kinds				Grand Total White Fish			
Year	Line	Trawl	Net	Total	Line	Trawl	Net	Total	Line	Trawl	Net	Total
1888	—	—	—	12,014	—	—	—	20,176	—	—	—	1,332,760
1889	—	—	—	10,875	—	—	—	16,389	—	—	—	1,454,175
1890	—	—	—	11,677	—	—	—	18,593	—	—	—	1,623,346
1891	—	—	—	11,513	—	—	—	20,876	—	—	—	1,762,494
1892	10,716	1,271	—	11,987	13,887	9,410	760	24,057	584,384	250,768	760,403	1,595,555
1893	10,725	1,015	—	11,740	10,726	9,215	891	20,832	531,156	278,315	815,425	1,624,896
1894	10,601	1,127	—	11,728	7,808	5.594	451	13,853	525,340	265,617	774,864	1,565,821
1895	12,379	1,097	—	13,476	6,042	4,036	294	10,372	548,629	291,165	924,197	1,763,991
1896	13,493	1,437	—	14,930	5,784	5,281	—	11,065	581,746	308,380	681,677	1,571.803
1897	16,681	1,569	—	18,250	5,860	5,696	—	11,556	570,031	343,656	714,067	1,627,754
1898	17,973	2,324	—	20,297	4,658	9,881	78	14,617	470,113	453,233	956,520	1,879,866
1899	16,814	3,958	—	20,772	3,580	15,019	—	18,599	439,851	600,259	1,149,823	2,189,933
1900	14,661	5,998	—	20,659	2,603	23,055	—	25,658	371,173	703,427	1,251,394	2,325,994
1901	14,088	6,822	—	20,910	2,753	28,273	—	31,026	341,892	825,027	1,071,391	2 238,310
1902	14,164	6,470	—	20,634	2,241	23,771	—	26,012	318,308	814,780	1,369.580	2,502,668
1903	11,431	7,775	—	19,206	2,257	18,898	—	21,155	315,955	829,932	1,255,400	2,401,287
1904	15,981	8,321	—	24,302	1,054	435	—	1,489	361,185	840,334	1,028,160	2,229,679
1905	16,600	8,980	—	25,580	895	472	—	1,367	348,610	946,737	1,352,421	2,647,768
1906	17,748	10,161	186	28,095	945	694	8	1,647	349,521	955,070	1,671,064	2,975,655
1907	16,036	10,139	217	26,392	539	1,017	5	1,561	338,423	992,184	1,838,089	3,168,696
1908	20,836	9,391	43	30,270	503	1,554	—	2,057	364,963	979,684	1,166,548	2,511,195

TABLE III.—SHELLFISH.

Scotland—(1) *Quantities.* I. *East Coast.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified
	Number.	Cwts.	Cwts.	Number.	Number.	Cwts.
1883	414,700	214,700	—	102,400	31,598*	20,176
1884	95,000	179,076	—	111,924	38,356*	15,345
1885	45,500	183,184	—	109,500	3,106,100	15,907
1886	51,100	168,482	9,100	123,625	2,119,300	15,553
1887	52,600	181,026	17,394	98,600	2,103,400	14,682
1888	43,400	199,961	20,674	85,825	2,967,600	14,415
1889	31,500	168,905	23,811	82,278	2,609,025	14,013
1890	16,900	150,366	25,706	94,114	2,733,596	20,288
1891	24,400	165,711	28,512	109,139	2,975,300	19,334
1892	18,800	132,089	20,709	135,896	3,026,992	20,385
1893	25,900	127,737	17,674	138,316	3,163,867	20,349
1894	26,500	97,378	25,554	113,945	2,568,495	18,267
1895	27,300	125,462	19,466	103,660	2,405,840	14,261
1896	13,100	148,658	22,335	96,484	3,256,935	16,027
1897	9,700	175,238	18,983	117,581	3,267,254	14,715
1898	4,000	128,005	13,600	92,340	3,533,020	15,795
1899	7,900	90,445	11,611	85,077	2,961,152	13,078
1900	2,600	79,425	6,258	74,911	2,999,519	12,852
1901	30,600	63,224	6,482	89,009	3,000,000	14,858
1902	28,237	59,123	4,320	91,841	2,878,492	14,278
1903	24,600	78,094	4,606	99,606	2,427,001	17,041
1904	18,700	70,623	6,974	127,308	2,202,393	15,010
1905	14,700	77,902	7,843	112,299	1,801,022	12,648
1906	—	79,529	7,381	93,319	1,909,353	13,228
1907	6,000	73,774	7,177	96,167	1,998,567	13,491
1908	14,900	82,711	8,623	104,332	2,573,158	12,508

II. *Orkney and Shetland.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified
	Number.	Cwts.	Cwts.	Number.	Number.	Cwts.
1883	6,000	500	—	46,800	—	9,688
1884	7,200	1,200	—	62,100	85*	8,038
1885	7,700	1,400	—	72,800	11,200	8,774
1886	5,550	5,420	—	107,750	9,500	13,445
1887	4,000	6,490	—	63,700	5,000	12,853
1888	1,800	4,280	—	93,400	8,400	15,923
1889	—	3,410	—	82,850	7,000	11,447
1890	8,000	3,505	—	101,450	9,650	8,772
1891	2,000	2,110	—	92,300	17,400	6,171
1892	3,000	4,510	—	124,600	17,150	8,392
1893	900	3,290	—	126,850	17,850	6,434
1894	1,600	7,305	—	101,350	11,450	7,911
1895	1,000	7,100	—	94,200	41,800	6,508
1896	1,200	7,650	—	79,000	19,900	7,092
1897	700	6,100	—	107,400	39,700	7,828
1898	—	2,558	—	102,403	17,800	7,320
1899	—	3,551	—	121,225	23,200	7,075
1900	—	5,510	—	104,439	18,200	5,818
1901	—	1,619	—	119,204	16,000	4,413
1902	300	2,155	—	120,029	30,390	4,285
1903	—	757	—	134,244	17,404	3,046
1904	—	537	11	161,560	12,900	3,996
1905	—	680	—	157,003	11,100	2,867
1906	—	690	—	161,537	12,300	2,544
1907	800	640	—	164,878	27,294	3,093
1908	3,200	860	—	127,877	31,500	3,044

* Cwts.

III. *West Coast.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified
	Number.	Cwts.	Cwts.	Number	Number.	Cwts.
1883	224,900	66,369	—	600,600	3,795*	19,552
1884	415,400	69,072	—	553,150	3,032*	17,863
1885	167,000	59,678	—	774,000	132,600	29,515
1886	239,000	87,360	—	517,975	255,850	34,233
1887	156,400	88,780	—	513,800	107,300	27,903
1888	107,500	45,386	—	498,950	105,775	25,240
1889	280,433	16,519	6	411,320	158,275	28,170
1890	325,300	27,323	55	447,644	139,095	25,109
1891	324,800	63,344	14	484,197	99,700	25,225
1892	293,200	110,587	60	480,521	73,850	33,360
1893	288,900	108,719	10	456,170	123,315	38,498
1894	263,700	78,678	29	504,870	100,196	34,373
1895	211,100	61,335	69	412,120	100,600	31,940
1896	274,399	87,183	18	575,817	120,547	36,789
1897	391,200	99,638	275	504,257	187,442	33,514
1898	402,000	61,175	413	471,683	95,759	34,870
1899	462,191	75,674	514	521,720	128,155	35,669
1900	793,860	58,487	114	501,124	110,309	38,058
1901	592,800	37,698	105	581,746	136,500	38,207
1902	262,316	34,385	—	574,482	167,374	36,906
1903	187,010	24,107	—	471,629	121,335	35,356
1904	231,400	20,982	8	507,536	184,044	38,025
1905	203,300	24,345	5	491,056	178,209	37,705
1906	389,650	48,267	10	476,706	169,954	29,822
1907	1,013,480	52,039	20	453,830	191,710	28,165
1908	924,261	37,590	10	456,802	132.054	33,711

IV. *All Coasts.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified
	Number.	Cwts.	Cwts.	Number.	Number.	Cwts.
1883	645,600	281,569	—	749,800	35,393*	49,416
1884	517,600	249,348	—	727,174	41,473*	41,246
1885	220,200	244,262	—	956,300	3,249,900	54,196
1886	295,650	261,262	9,100	749,350	2,384,650	63,231
1887	213,000	276,296	17,394	681,100	2,215,700	55,438
1888	152,700	249,627	20,674	678,175	3,081,775	55,578
1889	311,933	188,834	23,817	576,448	2,774,300	53,631
1890	350,200	181,194	25,761	643,208	2,882,341	54,169
1891	351,200	231,165	28,526	685,636	3,092,400	50,730
1892	315,000	247,186	20,769	741,017	3,117,992	62,137
1893	315,700	239,746	17,684	721,336	3,305,032	65,281
1894	291,800	183,361	25,583	720,165	2,680,141	60,551
1895	239,400	193,897	19,535	609,980	2,548,240	52,709
1896	288,699	243,491	22,353	751,301	3,397,382	59,908
1897	401,600	280,976	19,258	729,238	3,494,396	56,057
1898	406,000	191,738	14,013	666,426	3,646,579	57,985
1899	470,091	169,670	12,125	728,022	3,112,507	55,822
1900	796,460	143,422	6,372	680,474	3,128,028	56,728
1901	623,400	102,541	6,587	789,959	3,152,500	57,478
1902	290,853	95,663	4,320	786,352	3,076,256	55,469
1903	211,610	102,958	4,606	705,479	2,565,740	55,443
1904	250,100	92,142	6,993	796,404	2,399,337	57,031
1905	218,000	102,927	7,848	760,358	1,990,331	53,220
1906	389,650	128,486	7.391	731,562	2,091,607	45,594
1907	1,020,280	126,453	7,197	714,875	2,217,571	44,749
1908	942,361	121,161	8.633	689.011	2,736,712	49,263

* Cwts.

SHELLFISH.

Scotland—(2) *Values.* I. *East Coast.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value.
	£	£	£	£	£	£	£
1883	2,583	13,487	—	5,483	18,252	2,654	42,459
1884	547	12,210	—	5,794	22,428	2,163	43,142
1885	273	12,224	—	5,572	22,839	2,304	43,212
1886	325	11,308	1,256	6,375	12,427	2,118	33,809
1887	327	11,415	2,320	4,954	11,611	2,149	32,776
1888	260	13,029	2,918	4,324	14,207	2,119	36,857
1889	175	10,432	2,563	4,157	12,770	2,141	32,238
1890	105	9,512	3,297	4,803	13,900	3,097	34,714
1891	139	11,338	3,347	5,691	14,789	3,085	38,389
1892	112	9,534	2,733	6,505	16,254	3,170	38,308
1893	150	8,935	2,385	6,122	14,762	3,231	35,585
1894	148	6,527	3,309	5,715	12,538	3,049	31,286
1895	150	8,441	2,627	4,751	12,285	2,416	30,670
1896	69	9,469	2,910	4,939	15,205	2,623	35,215
1897	43	9,496	2,368	6,245	17,668	2,357	38,177
1898	16	7,159	1,555	4,547	17,477	2,651	33,405
1899	31	5,026	1,446	4,644	18,133	2,014	31,294
1900	11	4,156	846	4,156	17,219	2,173	28,561
1901	140	3,403	786	4,884	18,068	2,448	29,729
1902	173	3,212	586	5,297	17,649	2.511	29,428
1903	125	4,422	637	5,311	15,517	2,990	29,002
1904	82	4,087	940	6,468	13,807	2,582	27,966
1905	47	4,071	1,128	5,674	10,986	2,091	23,997
1906	—	4,111	1,082	4,841	12,493	2,131	24,658
1907	23	3,309	949	5,088	12,853	2,166	24,388
1908	57	3,590	1,262	5,489	15,752	2,065	28,215

II. *Orkney and Shetland.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value.
	£	£	£	£	£	£	£
1883	31	25	—	2,340	—	1,352	3,748
1884	38	300	—	3,105	16	1,165	4,624
1885	40	210	—	3,640	34	1,362	5,286
1886	22	478	—	5,488	30	2,221	8,239
1887	22	644	—	3,561	17	1,967	6,211
1888	5	348	—	4,966	25	2,579	7,923
1889	—	280	—	4,574	24	1,861	6,739
1890	36	186	—	5,435	46	1,330	7,033
1891	8	117	—	5,170	92	880	6,267
1892	12	238	—	6,134	79	1.286	7,749
1893	4	167	—	5,267	66	898	6,402
1894	7	392	—	4,224	60	1,059	5,742
1895	4	377	—	4,680	368	864	6,293
1896	5	388	—	3,234	111	918	4,656
1897	3	453	—	5,675	170	1,010	7,311
1898	—	143	—	6,391	75	1,065	7,674
1899	—	253	—	6,644	95	1,052	8,044
1900	—	352	—	6,072	109	907	7,440
1901	—	90	—	6,476	95	612	7,273
1902	1	162	—	6,125	166	514	6,968
1903	—	99	—	6,959	98	442	7,598
1904	—	57	2	8,740	55	611	9,465
1905	—	59	—	8,807	51	505	9,422
1906	—	67	—	9,113	58	429	9,667
1907	3	56	—	9,068	204	650	9,981
1908	13	67	—	7,398	224	549	8.251

III. *West Coast.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value.
	£	£	£	£	£	£	£
1883	792	3,036	—	25,143	1,464	6,303	36,738
1884	1,589	3,552	—	21,043	1,355	5,634	33,173
1885	496	2,933	—	25,869	867	10,530	40,695
1886	948	3,078	—	18,642	1,087	7,484	31,239
1887	616	3,352	—	18,132	679	5,549	28,328
1888	477	1,989	—	18,803	485	5,194	26,948
1889	1,278	965	1	15,718	603	5,659	24,224
1890	1,385	1,503	14	18,102	622	5,240	26,866
1891	1,421	2,874	3	20,807	414	5,990	31,509
1892	1,408	4,734	3	19,888	377	8,021	34,431
1893	1,327	4,240	3	19,147	541	8,109	33,367
1894	1,086	3,580	8	19,477	388	8,321	32,860
1895	953	3,308	18	16,125	422	8,644	29,470
1896	1,084	5,093	5	21,545	514	9,542	37,783
1897	1,568	4,413	40	20,506	557	9,831	36,915
1898	1,572	3,017	40	18,982	430	12,010	36,051
1899	1,853	3,579	39	22,862	533	12,347	41,213
1900	3,177	3,109	15	21,816	461	11,327	39,905
1901	2,307	2,483	16	25,283	535	13,463	44,087
1902	1,077	2,071	—	25,692	705	12,010	41,555
1903	769	1,686	—	22,297	699	11,547	36,998
1904	855	1,902	2	23,115	678	12,817	39,369
1905	818	1,935	1	21,836	638	12,015	37,243
1906	1,568	3,044	1	22,003	631	10,750	37,997
1907	3,430	2,969	4	20,794	717	9,921	37,835
1908	3,341	1,872	2	20,861	539	10,981	37,596

IV. *All Coasts.*

Year.	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value.
	£	£	£	£	£	£	£
1883	3,406	16,548	—	32,966	19,716	10,309	82,945
1884	2,174	16,062	—	29,942	23,799	8,962	80,939
1885	809	15,367	—	35,081	23,740	14,196	89,193
1886	1,295	14,864	1,256	30,505	13,544	11,823	73,287
1887	965	15,411	2,320	26,647	12,307	9,665	67,315
1888	742	15,366	2,918	28,093	14,717	9,892	71,728
1889	1,453	11,677	2,564	24,449	13,397	9,661	63,201
1890	1,526	11,201	3,311	28,340	14,568	9,667	68,613
1891	1,568	14,329	3,350	31,668	15,295	9,955	76,165
1892	1,532	14,506	2,736	32,527	16,710	12,477	80,488
1893	1,481	13,342	2,388	30,536	15,369	12,238	75,354
1894	1,241	10,499	3,317	29,416	12,986	12,429	69,888
1895	1,107	12,126	2,645	25,556	13,075	11,924	66,433
1896	1,158	14,950	2,915	29,718	15,830	13,083	77,654
1897	1,614	14,362	2,408	32,426	18,395	13,198	82,403
1898	1,588	10,319	1,595	29,920	17,982	15,726	77,130
1899	1,884	8,858	1,485	34,150	18,761	15,413	80,551
1900	3,188	7,617	861	32,044	17,789	14,407	75,906
1901	2,447	5,976	802	36,643	18,698	16,523	81,089
1902	1,251	5,445	586	37,114	18,520	15,035	77,951
1903	894	6,207	637	34,567	16,314	14,979	73,598
1904	937	6,046	944	38,323	14,540	16,010	76,800
1905	865	6,065	1,129	36,317	11,675	14,611	70,662
1906	1,568	7,222	1,083	35,957	13,182	13,310	72,322
1907	3,456	6,334	953	34,950	13,774	12,737	72,204
1908	3,411	5,529	1,264	33,748	16,515	13,595	74,062

Scotland—I. *East Coast.*

Year.	Percentage, to Total Value of Shellfish, of						Percentage of Total Value of Shellfish of East Coast to	
	Oysters	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value of Shellfish of Whole of Scotland.	Total Value of All Fish of East Coast.
1883	6·08	31·77	—	12·91	42·99	6·25	51·19	—
1884	1·27	28·30	—	13·43	51·99	5·01	53·30	—
1885	·63	28·29	—	12·89	52·85	5·33	48·45	—
1886	·96	33·45	3·72	18·86	36·76	6·26	46·13	—
1887	1·00	34·82	7·08	15·11	35·42	6·56	48·69	—
1888	·70	35·35	7·92	11·73	38·55	5·75	51·38	—
1889	·54	32·36	7·95	12·90	39·61	6·64	51·01	2·91
1890	·30	27·40	9·50	13·84	40·04	8·92	50·59	2·93
1891	·36	29·54	8·72	14·83	38·52	8·04	50·40	2·96
1892	·29	24·89	7·13	16·98	42·42	8·28	47·59	3·07
1893	·42	25·11	6·70	17·20	41·48	9·08	47·22	2·83
1894	·47	20·86	10·58	18·27	40·08	9·75	44·77	2·68
1895	·49	27·53	8·57	15·49	40·04	7·87	46·17	2·23
1896	·20	26·89	8·26	14·02	43·18	7·45	45·35	2·88
1897	·11	24·88	6·20	16·36	46·28	6·17	46·33	3·04
1898	·05	21·43	4·65	13·61	52·32	7·94	43·31	2·32
1899	·10	16·06	4·62	14·84	57·94	6·44	38·85	1·96
1900	·04	14·55	2·96	14·55	60·28	7·61	37·63	1·72
1901	·47	11·45	2·65	16·43	60·78	8·24	36·66	1·86
1902	·59	10·91	1·99	18·00	59·97	8·52	37·75	1·51
1903	·43	15·25	2·20	18·31	53·50	10·31	39·41	1·63
1904	·29	14·61	3·36	23·13	49·37	9·23	36·41	1·73
1905	·20	16·96	4·70	23·64	45·78	8·71	33·96	1·37
1906	—	16·67	4·39	19·63	50·67	8·65	34·09	1·21
1907	·09	13·56	3·89	20·86	52·70	8·88	33·78	1·07
1908	·20	12·72	4·47	19·46	55·83	7·32	38·10	1·57

II. *Orkney and Shetland.*

Year.	Percentage, to Total Value of Shellfish, of						Percentage of Total Value of Shellfish of Orkney & Shetland to	
	Oysters	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value of Shellfish of Whole of Scotland.	Total Value of All Fish of Orkney and Shetland.
1883	·83	·67	—	62·44	—	36·07	4·52	—
1884	·82	6·49	—	67·15	·35	25·19	5·71	—
1885	·76	3·97	—	68·86	·64	25·77	5·93	—
1886	·27	5·80	—	66·61	·36	26·96	11·24	—
1887	·35	10·37	—	57·33	·27	31·67	9·23	—
1888	·06	4·39	—	62·68	·32	32·55	11·05	—
1889	—	4·16	—	67·85	·36	27·62	10·66	6·04
1890	·51	2·64	—	77·28	·65	18·91	10·25	5·44
1891	·13	1·87	—	82·50	1·47	14·04	8·23	4·33
1892	·15	3·07	—	79·16	1·02	16·60	9·63	8·64
1893	·06	2·61	—	82·27	1·03	14·03	8·50	5·00
1894	·12	6·83	—	73·56	1·04	18·44	8·22	3·14
1895	·06	5·99	—	74·37	5·85	13·73	9·47	3·70
1896	·11	8·33	—	69·46	2·38	19·72	6·00	2·88
1897	·04	6·20	—	77·62	2·33	13·81	8·87	4·33
1898	—	1·86	—	83·28	·98	13·88	9·95	4·09
1899	—	3·15	—	82·60	1·18	13·08	9·99	2·61
1900	—	4·73	—	81·61	1·47	12·19	9·80	2·04
1901	—	1·24	—	89·04	1·31	8·41	8·97	1·92
1902	·01	2·32	—	87·90	2·38	7·38	8·94	1·96
1903	—	1·30	—	91·59	1·29	5·82	10·32	2·17
1904	—	·60	·02	92·34	·58	6·46	12·32	2·38
1905	—	·63	—	93·47	·54	5·36	13·33	1·43
1906	—	·69	—	94·26	·60	4·44	13·37	1·46
1907	·03	·56	—	90·85	2·04	6·51	13·82	1·57
1908	·16	·81	—	89·66	2·71	6·65	11·14	1·77

III. *West Coast.*

Year.	Percentage, to Total Value of Shellfish, of						Percentage of Total Value of Shellfish of West Coast to	
	Oysters	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	Total Value of Shellfish of Whole of Scotland.	Total Value of All Fish of West Coast.
1883	2·16	8·27	—	68·44	3·96	17·16	44·29	—
1884	4·79	10·71	—	63·43	4·09	16·98	40·99	—
1885	1·22	7·21	—	63·57	2·13	25·87	45·63	—
1886	3·03	9·85	—	59·68	3·48	23·96	42·63	—
1887	2·17	11·83	—	64·01	2·40	19·59	42·08	—
1888	1·77	7·37	—	69·78	1·80	19·27	37·57	—
1889	5·28	3·98	0·00	64·89	2·49	23·36	38·33	8·08
1890	5·16	5·60	·05	67·38	2·32	19·50	39·16	7·14
1891	4·51	9·12	·01	66·04	1·31	19·01	41·37	7·96
1892	4·09	13·75	·01	57·76	1·09	23·30	42·78	10·11
1893	3·98	12·71	·01	57·38	1·62	24·30	44·28	10·65
1894	3·30	10·87	·02	59·27	1·18	25·32	47·02	11·58
1895	3·23	11·23	·06	54·72	1·43	29·34	44·35	10·35
1896	2·87	13·48	·01	57·02	1·36	25·25	48·66	14·44
1897	4·25	11·96	·11	55·55	1·51	26·63	44·80	12·99
1898	4·36	8·37	·11	52·65	1·19	33·31	46·74	10·91
1899	4·50	8·68	·09	55·47	1·29	29·96	51·16	11·20
1900	7·96	7·79	·04	54·67	1·16	28·39	52·57	10·66
1901	5·23	5·63	·04	57·35	1·21	30·54	54·37	13·00
1902	2·59	4·98	—	61·83	1·70	28·90	53·31	11·23
1903	2·08	4·56	—	60·27	1·89	31·21	50·27	10·70
1904	2·17	4·83	·01	58·71	1·72	32·56	51·26	13·54
1905	2·20	5·20	0·00	58·63	1·71	32·26	52·71	12·40
1906	4·13	8·01	·00	57·90	1·66	28·29	52·54	12·23
1907	9·07	7·85	·01	54·96	1·89	26·22	52·40	11·90
1908	8·89	4·98	·01	55·49	1·43	29·21	50·76	11·80

IV. *All Coasts.*

Year.	Percentage, to Total Value of Shellfish, of						Percentage of Total Value of Shellfish of Scotland to Total Value of All Fish of Scotland.
	Oysters.	Mussels.	Clams.	Lobsters.	Crabs.	Unclassified.	
1883	4·11	19·95	—	39·74	23·77	12·43	—
1884	2·69	19·84	—	36·99	29·40	11·07	—
1885	·91	17·23	—	39·33	26·62	15·92	—
1886	1·77	20·28	1·71	41·62	18·48	16·13	—
1887	1·43	22·89	3·45	39·59	18·28	14·36	—
1888	1·03	21·42	4·07	39·17	20·52	13·79	—
1889	2·30	18·48	4·06	38·68	21·21	15·29	4·17
1890	2·22	16·33	4·83	41·30	21·23	14·09	4·06
1891	2·06	18·81	4·40	41·58	20·08	13·07	4·14
1892	1·90	18·02	3·40	40·41	20·76	15·50	4·81
1893	1·97	17·71	3·17	40·52	20·40	16·24	4·43
1894	1·77	15·02	4·75	42·09	18·58	17·78	4·27
1895	1·67	18·25	3·98	38·47	19·68	17·95	3·63
1896	1·49	19·25	3·75	38·27	20·39	16·85	4·71
1897	1·96	17·43	2·92	39·35	22·32	16·02	4·82
1898	2·06	13·38	2·07	38·79	23·31	20·39	3·94
1899	2·34	11·00	1·82	42·40	23·29	19·13	3·55
1900	4·20	10·03	1·13	42·21	23·44	18·98	3·16
1901	3·02	7·37	·99	45·19	23·06	20·38	3·50
1902	1·60	6·99	·75	47·61	23·76	19·29	3·02
1903	1·21	8·43	·87	46·97	22·17	20·35	2·97
1904	1·22	7·87	1·23	49·90	18·93	20·85	3·33
1905	1·22	8·58	1·60	51·40	16·52	20·68	2·60
1906	2·17	9·99	1·50	49·72	18·23	18·40	2·37
1907	4·79	8·77	1·32	48·40	19·08	17·64	2·23
1908	4·61	7·47	1·71	45·57	22·30	18·36	2·86

England and Wales—(1) East Coast.

Year.	TOTAL QUANTITY AND VALUE OF SHELLFISH LANDED.									Total Quantity and Value of Fish (excluding Shellfish).		Total Value of All Fish Landed.
	Lobsters.		Crabs.		Oysters.		Other Shellfish.		Total Value.	East Coast.		
	Number.	£	Number.	£	Number.	£	Cwts.	£	£	Cwts.	£	£
1886	89,680	3,630	2,240,999	17,991	41,177,000	124,809	260,415	62,793	209,223	5,321,656	3,148,088	3,357,311
1887	73,884	3,266	3,344,044	25,143	49,624,000	154,064	306,953	73,349	255,822	5,157,678	3,216,655	3,472,477
1888	60,499	2,978	3,894,498	24,162	26,253,000	90,993	351,058	83,731	201,864	5,260,350	3,188,896	3,390,760
1889	80,836	3,578	4,072,296	26,122	30,301,000	90,624	354,432	88,638	208,962	5,223,635	2,918,239	3,127,201
1890	75,916	3,605	3,798,563	28,827	37,970,000	123,305	387,269	88,834	244,571	4,719,237	3,189,924	3,434,495
1891	93,065	4,105	3,745,240	28,367	33,688,000	119,555	399,134	106,181	258,208	4,670,646	3,445,639	3,703,847
1892	117,607	5,240	3,501,112	26,969	27,412,000	92,396	387,042	98,600	223,205	5,105,814	3,546,422	3,769,627
1893	136,670	6,334	3,870,984	27,020	22,611,000	74,979	457,460	107,073	215,406	5,320,596	3,820,924	4,036,330
1894	122,246	5,162	3,269,831	24,674	16,833,000	58,300	403,609	102,560	190,696	5,737,596	3,970,889	4,161,585
1895	141,745	5,938	3,403,878	25,720	15,555,000	55,973	456,685	102,661	190,292	5,991,331	4,106,802	4,297,094
1896	168,847	7,076	3,800,684	28,175	20,796,000	71,581	435,488	107,699	214,531	6,125,162	4,062,538	4,277,069
1897	149,659	6,502	2,988,931	24,891	26,577,000	95,841	390,954	98,349	225,583	6,270,892	4,349,155	4,574,738
1898	143,137	6,458	4,335,546	32,068	26,460,000	105,006	382,700	98,044	241,576	6,344,822	4,455,553	4,697,129
1899	141,454	6,471	3,697,491	29,310	29,300,000	125,291	386,703	92,631	253,703	6,929,271	5,146,995	5,400,698
1900	132,609	6,297	4,309,000	33,531	28,868,000	114,594	393,454	104,488	258,910	7,091,285	5,378,850	5,637,760
1901	138,714	6,565	4,536,118	36,652	28,054,000	102,886	252,391	62,900	209,003	7,024,497	5,237,709	5,446,712
1902	122,006	5,609	4,727,572	37,570	32,145,000	97,127	260,489	59,646	199,952	8,801,904	5,158,480	5,358,432
1903	136,597	6,050	4,213,374	32,892	24,048,000	74,111	228,785	65,839	178,892	9,539,114	5,721,105	5,899,997
1904	138,122	6,479	3,781,752	28,457	31,909,000	89,882	271,611	69,586	194,404	9,349,040	5,268,896	5,463,300
1905	106,140	5,097	4,148,973	30,496	31,856,400	94,685	292,118	71,730	202,008	9,058,534	5,857,406	6,059,414
1906	113,337	5,422	4,015,524	29,251	31,542,390	100,573	298,281	68,168	203,414	10,047,648	6,261,765	6,465,179
1907	94,617	4,775	3,899,561	28,403	28,974,965	98,044	294,277	71,157	202,379	11,467,437	6,247,919	6,450,298

England and Wales—(2) South Coast.

Year.	TOTAL QUANTITY AND VALUE OF SHELLFISH LANDED.									Total Quantity and Value of Fish (excluding Shellfish).		Total Value of All Fish Landed.
	Lobsters.		Crabs.		Oysters.		Other Shellfish.		Total Value.	South Coast.		
	Number.	£	Number.	£	Number.	£	Cwts.	£	£	Cwts.	£	£
1886	325,367	14,291	527,813	20,368	3,229,000	7,330	21,251	9,333	51,322	871,041	407,170	458,492
1887	399,298	18,472	629,759	23,240	2,843,000	6,709	29,421	10,759	59,180	642,914	404,010	463,190
1888	338,186	15,634	635,502	23,377	2,399,000	5,172	35,159	9,928	54,111	605,808	429,514	483,625
1889	467,916	21,658	676,067	24,226	2,967,000	6,348	29,719	9,103	61,335	632,471	503,919	565,254
1890	595,567	28,764	744,384	25,023	3,917,000	8,417	32,240	11,138	73,342	586,501	516,569	589,911
1891	530,937	24,953	632,431	21,152	4,331,000	9,157	45,790	13,976	69,238	595,705	489,016	558,254
1892	623,576	28,426	766,022	28,970	4,756,000	11,220	35,457	14,229	82,845	599,749	498,818	581,663
1893	508,858	21,699	812,722	26,149	4,091,000	11,413	40,389	16,886	76,147	560,590	490,402	566,549
1894	467,010	19,800	828,158	24,425	4,251,000	11,186	39,262	16,524	71,935	624,791	483,181	555,116
1895	442,479	19,818	893,338	26,409	2,480,000	5,927	43,001	15,290	67,444	587,936	496,887	564,331
1896	499,208	21,492	1,028,541	29,427	3,295,000	8,037	34,920	14,091	73,047	691,854	516,858	589,905
1897	441,642	19,153	911,296	26,791	4,281,000	9,107	26,474	14,706	69,753	732,447	549,662	619,415
1898	485,938	20,171	1,078,108	32,327	5,911,000	10,261	37,166	17,075	79,834	626,137	493,380	573,214
1899	448,846	18,698	1,043,998	30,984	5,944,000	10,564	51,412	20,089	80,335	736,559	517,280	597,615
1900	365,675	16,279	725,888	21,594	4,374,000	7,741	48,389	17,825	63,439	639,348	523,917	587,356
1901	351,031	16,201	644,969	20,457	4,274,000	7,890	44,673	16,488	61,036	715,250	568,199	629,235
1902	363,547	17,450	642,034	21,341	5,302,000	9,979	34,558	15,575	64,345	678,838	541,781	606,126
1903	274,350	13,966	585,333	20,045	624,000	1,453	24,921	11,953	47,417	664,435	447,943	495,360
1904	298,675	14,748	618,145	21,623	1,367,000	2,995	20,288	12,654	52,020	827,095	458,054	510,074
1905	326,961	15,739	807,356	27,027	1,343,900	3,197	27,312	17,700	63,663	1,030,574	512,384	576,047
1906	339,323	16,608	799,179	28,253	2,015,449	4,452	23,604	14,670	63,983	739,156	397,875	461,858
1907	349,700	16,781	768,494	26,665	2,478,781	5,224	35,166	21,000	69,670	747,605	398,281	467,951

England and Wales—(3) West Coast.

Year.	TOTAL QUANTITY AND VALUE OF SHELLFISH LANDED.									Total Quantity and Value of Fish (excluding Shellfish).		Total Value of All Fish Landed.
	Lobsters.		Crabs.		Oysters.		Other Shellfish.		Total Value.	West Coast.		
	Number.	£	Number.	£	Number.	£	Cwts.	£	£	Cwts.	£	£
1886	37,050	1,091	94,547	1,003	1,148,000	2,917	7,343	3,440	8,451	219,736	132,821	141,272
1887	44,524	1,918	106,834	1,480	1,110,000	2,482	7,346	3,619	9,499	228,889	158,293	167,792
1888	70,866	2,261	219,655	1,835	578,000	1,539	10,291	3,334	8,969	481,914	329,603	338,572
1889	170,797	5,076	334,143	3,297	3,459,000	6,865	76,247	21,006	36,244	588,458	440,231	476,475
1890	250,530	12,758	264,694	2,956	5,677,000	13,486	85,711	26,947	56,147	794,892	662,059	718,206
1891	106,296	5,386	233,899	2,792	6,066,000	13,329	88,568	30,601	52,108	699,725	556,363	608,471
1892	117,170	5,003	253,591	3,130	4,725,000	10,268	91,660	30,116	48,517	780,136	583,465	631,982
1893	101,405	4,625	324,378	3,416	5,753,000	13,083	70,679	31,131	52,255	697,448	515,974	568,229
1894	138,735	6,423	241,198	3,303	6,663,000	14,785	55,432	22,374	46,885	661,576	527,890	574,775
1895	93,207	4,141	203,691	2,937	7,241,000	15,771	90,542	28,243	51,092	684,328	525,400	576,492
1896	264,316	16,961	200,620	3,406	5,101,000	10,965	73,609	24,731	56,063	733,662	587,384	643,447
1897	109,112	5,679	148,266	2,875	3,694,000	7,566	106,013	23,642	39,762	942,769	670,161	709,923
1898	196,487	9,065	214,460	3,500	3,438,000	7,053	120,971	27,934	47,552	1,117,164	812,672	860,224
1899	199,900	7,450	176,695	2,200	3,738,000	7,991	122,088	32,564	50,205	938,977	677,747	727,952
1900	155,868	6,014	142,462	1,697	4,605,000	9,690	97,537	31,768	49,169	869,428	707,501	756,670
1901	160,746	5,969	144,887	1,634	4,973,000	10,409	104,323	36,618	54,630	908,058	717,615	772,245
1902	163,183	6,344	151,815	1,772	5,100,000	10,149	120,002	36,927	55,192	998,667	796,625	851,817
1903	138,404	5,415	124,829	1,390	3,460,000	6,767	105,047	39,056	52,628	994,691	761,379	814,007
1904	115,218	4,602	180,421	2,476	1,323,000	1,809	105,783	34,752	43,639	1,188,949	762,974	806,613
1905	69,572	3,118	150,016	1,956	2,226,400	4,223	103,899	27,156	36,453	1,220,652	830,854	867,307
1906	67,997	3,226	152,444	2,154	1,603,368	2,825	203,072	48,343	56,548	1,407,716	981,647	1,038,195
1907	51,009	2,245	134,614	1,855	925,341	1,879	222,557	51,144	57,123	1,779,269	1,180,064	1,237,187

(4) *England and Wales.*

Year.	TOTAL QUANTITY AND VALUE OF SHELLFISH LANDED. Lobsters. Number.	Lobsters. £	Crabs. Number.	Crabs. £	Oysters. Number.	Oysters. £	Other Shellfish. Cwts.	Other Shellfish. £	Total Value. £	Total Quantity and Value (excluding Shellfish). Total. Cwts.	Total. £	Total Value of All Fish Landed. £
1886	452,097	19,012	2,863,359	39,362	45,554,000	135,056	289,009	75,566	268,996	6,412,433	3,688,079	3,957,075
1887	517,706	23,656	4,080,637	49,863	53,577,000	163,255	343,720	87,727	324,501	6,029,481	3,778,958	4,103,459
1888	469,551	20,873	4,749,655	49,374	29,230,000	97,704	396,508	96,993	264,944	6,348,072	3,948,013	4,212,957
1889	719,549	30,312	5,082,506	53,645	36,727,000	103,837	460,398	118,747	306,541	6,464,564	3,862,389	4,168,930
1890	922,013	45,127	4,807,640	56,806	47,564,000	145,208	505,220	126,919	374,060	6,100,630	4,368,552	4,742,612
1891	730,298	34,444	4,611,570	52,311	44,085,000	142,041	533,492	150,758	379,554	5,966,076	4,491,018	4,870,572
1892	858,353	38,669	4,520,725	59,069	36,893,000	113,884	514,159	142,945	354,567	6,485,699	4,628,705	4,983,272
1893	746,933	32,658	5,008,084	56,585	32,455,000	99,475	568,528	155,090	343,808	6,578,634	4,827,300	5,171,108
1894	727,991	31,385	4,339,187	52,402	27,747,000	84,271	498,303	141,458	309,516	7,023,963	4,981,960	5,291,476
1895	677,431	29,897	4,500,907	55,066	25,276,000	77,671	590,228	146,194	308,828	7,263,595	5,129,089	5,437,917
1896	932,371	45,529	5,029,845	61,008	29,192,000	90,583	544,017	146,521	343,641	7,550,678	5,166,780	5,510,421
1897	700,413	31,334	4,048,493	54,557	34,552,000	112,514	523,441	136,693	335,098	7,946,108	5,568,978	5,904,076
1898	825,562	35,694	5,628,114	67,895	35,809,000	122,320	540,837	143,053	368,962	8,088,123	5,761,605	6,130,567
1899	790,200	32,619	4,918,184	62,494	38,982,000	143,846	560,203	145,284	384,243	8,604,807	6,342,022	6.726,265
1900	654,152	28,590	5,177,350	56,822	37,847,000	132,025	539,380	154,081	371,518	8,600,061	6,610,268	6,981,786
1901	650,491	28,735	5,325,974	58,743	37,301,000	121,185	401,387	116,006	324,669	8,647,805	6,523,523	6,848,192
1902	648,736	29,403	5,521,421	60,683	42,547,000	117,255	415,049	112,148	319,489	10,479,409	6,496,886	6,816,375
1903	549,351	25,431	4,923,536	54,327	28,132,000	82,331	358,753	116,848	278,937	11,198,240	6,930,427	7,209,364
1904	552,015	25,829	4,580,318	52,556	34,599,000	94,686	397,682	116,992	290,063	11,365,084	6,489,924	6,779,987
1905	502,673	23,954	5,106,345	59,479	36,426,700	102,105	423,329	116,586	302,124	11,309,760	7,200,644	7,502,768
1906	520,657	25,256	4,967,147	59,658	35,161,207	107,850	524,957	131,181	323,945	12,194,520	7,641,287	7,965,232
1907	495,326	23,801	4,802,669	56,923	32,379,087	105,147	552,000	143,301	329,172	13,994,311	7,826,264	8,155,436

(1) *East Coast.*

Year.	Percentage, to Total Value of Shellfish, of				Percentage of Total Value of Shellfish of East Coast to	
	Lobsters.	Crabs.	Oysters.	Unclassified	Total Value of Shellfish of England and Wales.	Total Value of All Fish of East Coast.
1886	1·74	8·60	59·65	30·01	77·78	6·23
1887	1·28	9·83	60·22	28·67	78·84	7·37
1888	1·48	11·97	45·08	41·48	76·19	5·95
1889	1·71	12·50	43·37	42·42	68·17	6·68
1890	1·47	11·79	50·42	36·32	65·36	7·01
1891	1·59	10·99	46·30	41·12	68·03	6·97
1892	2·35	12·08	41·40	44·17	62·95	5·90
1893	2·94	12·54	34·81	49·71	62·65	5·34
1894	2·71	12·94	30·57	53·78	61·61	4·58
1895	3·12	13·52	29·41	53·95	61·62	4·43
1896	3·30	13·13	33·37	50·20	62·43	5·02
1897	2·88	11·03	42·49	43·59	67·32	4·93
1898	2·67	13·27	43·47	40·59	65·47	5·14
1899	2·55	11·55	49·38	36·51	66·03	4·70
1900	2·43	12·95	44·26	40·36	69·69	4·59
1901	3·14	17·54	49·22	30·10	64·37	3·84
1902	2·80	18·80	48·58	29·83	62·58	3·73
1903	3·38	18·39	41·43	36·80	64·13	3·03
1904	3·33	14·64	46·23	35·79	67·02	3·56
1905	2·52	15·10	46·87	35·51	66·86	3·33
1906	2·67	14·38	49·44	33·51	62·79	3·13
1907	2·36	14·03	48·45	35·16	61·48	3·14

(2) *South Coast.*

Year.	Percentage, to Total Value of Shellfish, of				Percentage of Total Value of Shellfish of South Coast to	
	Lobsters.	Crabs.	Oysters.	Unclassified	Total Value of Sheilfish of England and Wales.	Total Value of All Fish of South Coast.
1886	27·85	39·69	14·28	18·18	19·08	11·19
1887	31·21	39·27	11·34	18·18	18·24	12·78
1888	28·89	43·20	9·56	18·35	20·42	11·19
1889	35·31	39·50	10·35	14·84	20·01	10·85
1890	39·22	34·12	11·48	15·19	19·61	12·43
1891	36·04	30·55	13·23	20·19	18·24	12·40
1892	34·31	34·97	13·54	17·18	23·37	14·24
1893	28·50	34·34	14·99	22·18	22·15	13·44
1894	27·52	33·95	15·55	22·97	23·24	12·96
1895	29·38	39·16	8·79	22·67	21·84	11·95
1896	29·42	40·29	11·00	19·29	21·26	12·38
1897	27·46	38·41	13·06	21·08	20·82	11·26
1898	25·27	40·49	12·85	21·39	21·64	13·93
1899	23·28	38·57	13·15	25·01	20·91	13·44
1900	25·66	34·04	12·20	28·10	17·08	10·80
1901	26·54	33·52	12·93	27·01	18·80	9·70
1902	27·12	33·17	15·51	24·21	20·14	10·62
1903	29·45	42·27	3·06	25·21	17·00	9·57
1904	28·35	41·57	5·76	24·33	17·93	10·20
1905	24·72	42·45	5·02	27·80	21·07	11·05
1906	25·96	44·16	6·96	22·93	19·75	13·85
1907	24·09	38·27	7·50	30·14	21·17	14·88

(3) *West Coast.*

Year.	Percentage, to Total Value of Shellfish, of				Percentage of Total Value of Shellfish of West Coast to	
	Lobsters.	Crabs.	Oysters.	Unclassified	Total Value of Shellfish of England and Wales.	Total Value of All Fish of West Coast.
1886	12·91	11·87	34·52	40·70	3·14	5·98
1887	20·19	15·58	26·13	38·10	2·93	5·66
1888	25·21	20·46	17·16	37·17	3·39	2·65
1889	14·01	9·10	18.94	57·96	11·82	7·61
1890	22·72	5·26	24·02	48·00	15·01	7·82
1891	10·34	5·36	25·58	58·73	13·73	8·56
1892	10·31	6·45	21·16	62·07	13·68	7·68
1893	8·85	6·54	25·04	59·57	15·20	9·20
1894	13·70	7·04	31·53	47·72	15·15	8·16
1895	8·10	5·75	30·87	55·28	16·54	8·86
1896	30·25	6·08	19·56	44·11	16·31	8·71
1897	14·28	7·23	19·03	59·46	11·87	5·60
1898	19·06	7·36	14·83	58·74	12·89	5·53
1899	14·84	4·38	15·92	64·86	13·07	6·90
1900	12·23	3·45	19·71	64·61	13·23	6·50
1901	10·93	2·99	19·05	67·03	16·83	7·07
1902	11·49	3·21	18·39	66·91	17·28	6·48
1903	10·29	2·64	12·86	74·21	18·87	6·47
1904	10·55	5·67	4·15	79·63	15·04	5·41
1905	8·55	5·37	11·58	74·50	12·07	4·20
1906	5·70	3·81	5·00	85·49	17·46	5·45
1907	3·93	3·25	3·29	89·53	17·35	4·62

(4) *England and Wales.*

Year.	Percentage, to Total Value of Shellfish, of				Percentage of Total Value of Shellfish of England and Wales to Total Value of All Fish of England and Wales.
	Lobsters.	Crabs.	Oysters.	Unclassified.	
1886	7·07	14·63	50·21	28·09	6·80
1887	7·29	15·37	50·31	27·03	7·98
1888	7·88	18·63	36·88	36·61	6·29
1889	9·89	17·50	33·87	38·74	7·35
1890	12·06	15·19	38·82	33·93	7·89
1891	9·08	13·78	37·42	39·72	7·79
1892	10·91	16·66	32·12	40·31	7·12
1893	9·50	16·46	28·93	45·11	6·65
1894	10·14	16·93	27·23	45·70	5·85
1895	9·68	17·83	25·15	47·34	5·68
1896	13·25	17·75	26·36	42·64	6·24
1897	9·35	16·28	33·58	40·79	5·68
1898	9·67	18·40	33·15	38·77	6·02
1899	8·49	16·26	37·44	37·81	5·71
1900	7·69	15·29	35·54	41·47	5·32
1901	8·85	18·09	37·33	35·73	4·74
1902	9·21	18·99	36·70	35·10	4·69
1903	9·12	19·47	29·52	41·90	3·87
1904	8·90	18·12	32·64	40·33	4·28
1905	7·93	19·69	33·80	38·58	4·03
1906	7·80	18·42	33·29	40·49	4·07
1907	7·23	17·29	31·94	43·53	4·04

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